ERRATA.

VOL III.

Page 53, line 7, *axoun*
—— 59, line 17, read *per artus, Ire*
—— 151, line 2, for refractions, read *retractions*
—— 157, line 19, for it is as, read *as it is*
—— 160, line 11, for did, read *do*
—— 176, line 6, for helmock, read *hemlock*
—— 199, line 15, for deposits, read *depositing*
—— 212, line 9, for woundrous, read *wondrous*
—— line 21, for when, read *where*
—— 240, last line, read *so formidable or*
—— 285, line 15, for ravages, read *ravagers*
—— 300, line 15, read *bleating*
—— 358, line 1, for successfully, read *successively*
—— 368, line 25, read *animalcula*
—— 382, line 12, for more, read *most*
—— 383, line 19, for these, read *those*
—— 435, line 6, read *aiebat*

A

VIEW OF NATURE,

IN LETTERS

TO A TRAVELLER AMONG THE ALPS.

WITH

REFLECTIONS

ON

ATHEISTICAL PHILOSOPHY,

NOW EXEMPLIFIED IN

FRANCE.

By RICHARD JOSEPH SULIVAN, Esq.
F.R.S. AND F.A.S.

Mala enim, et impia consuetudo est contra Deos disputandi, sive ex animo id fit, sive simulate.

CICERO.

IN SIX VOLUMES.

VOL. III.

LONDON:
PRINTED FOR T. BECKET, PALL MALL,
BOOKSELLER TO HIS ROYAL HIGHNESS
THE PRINCE OF WALES,
AND THEIR ROYAL HIGHNESSES, THE DUKES OF YORK AND CLARENCE, AND THE JUNIOR PRINCES.
1794.

A

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MVSEVM
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ALBANY, AND YORK PALACE.

CONTENTS.

LETTER LI.

IMPORTANCE of the study of nature---this study more successfully pursued by the moderns than by the ancients---Infinite variety of vegetable and animal nature---different sources of pleasure in this study---ground of the usual arrangement of natural bodies---the same elementary principles in animals and vegetables---operations of the animal œconomy common to all animals---specific differences---digestion not accompanied by putrefaction---antiseptic virtue of the Gastric fluid---modes of nutrition---Irritation ---Sensibility---Thought---The nervous system the organ of sensibility---the manner in which it acts unknown---different theories concerning the seat of sensation.

LETTER LII.

Animal motion not to be explained on mechanical principles---Different modes of animal existence; sleeping and waking---The different senses, their seats, and modes of action---The soul, an invisible agent ---connection between it and the senses---its intellectual powers---Activity apparent through all nature, but the soul has within itself a distinct source

of intelligence---distinct characters of body and mind---the latter as distinctly perceived as the former---no sufficient argument against its immaterial existence---the Epicurean explanation of the phænomena of mind unphilosophical---sources of the error---no necessary relation between motion and thought---whatever dependence mind has upon body, is arbitrary, and can only be referred to divine power ---Absurdities attending the doctrine of the materiality of mind.

LETTER LIII.

Facts illustrating and confirming the intimate union of the soul and body---Whether the soul is ever totally inactive---phænomena of dreaming---no rational theory of dreaming has been given.

LETTER LIV.

Freedom of inquiry ought to be unlimited---The opposite systems of universal materialism, and universal spiritualism ably supported---absurdities attending each---Spinoza's system---Berkeley's---The folly of rejecting the testimony of the senses.

LETTER LV.

Sketch of the doctrines of the ancients and the moderns concerning ideas---Locke's opinion concerning the sourcesof our ideas controverted---The doctrine of *innate ideas* maintained---All ideas the effect of reflection---if merely the result of impressions, the mind would have no activity---Man has innate

principles, which, when discovered and brought into action, form the human character---Instinct belongs to man, as well as to inferior animals---Innate notions dormant till called forth by reason.

LETTER LVI.

Man compared with other animals---his superiority denied by some philosophers—The social, not the savage state, natural to man---man superior in the powers of language---in a capacity of improvement---The internal differences between man and beast greater than the external---Various opinions concerning the brute creation---instances of instinctive sagacity in brutes---of superior intelligence in man.

LETTER LVII.

Language an original gift of heaven to man---other proofs of intellectual superiority of man to brutes---wonderful advances in arts and sciences---innumerable improvements in the state of the animal and vegetable world through human industry and ingenuity ---diversity of powers, freedom of will, innate moral principles, and a capacity of improvement, characteristic distinctions of human nature---man by nature a social being---his improvement and happiness the result of social union.

LETTER LVIII.

Classes of animals---miscellaneous observations respecting amphibious animals—quadrupeds---fishes---birds---insects---Animal existence diffused through every

every part of nature---Wonderful minuteness of organized and animated bodies---Variety and perfection of the insect tribes---The class of fishes, according to some philosophers, first in the order of animal life ---that animals should be destroyed by animals, an universal law of nature---different temperature of animals--- some lie long in a torpid state---easy transitions in nanure from one class of animated beings to another- -the world itself supposed by some to be an animal---ancient doctrines of the soul of the world, and of the transmigration of souls--- The gregarious character of certain animals—Migration

LETTER LIX.

Of the vegetable kingdom---particulars in which vegetables resemble animals---various methods of classification--different parts of a plant---general idea of the Linnæan, or sexual system---different processes of nature in vegetation---the constituent parts of vegetables, and the causes of their varieties, imperfectly known---The physiology of vegetables---the sexual distinction of plants known to the ancients---different opinions of moderns concerning the sexual system of vegetation---chymical analysis of plants---vegetable charcoal---vegetative subservient to animal life.

LETTER LX.

Of Life, vegetable and animal---their similarity, in production, support, anatomy, destruction---the essential causes of animal life and motion unknown---fire appears

pears to be one of its principles---air and water also necessary to its existence---life and death in perpetual circulation---the cure of vegetable disease.

LETTER LXI.

Of the provision in nature for the continuance of vegetable and animal existence---their first origin only to be accounted for on the supposition of an Eternal Intelligent Being---other unsatisfactory hypotheses enumerated---Different systems of propagation---primary organic particles---seminal animalcula---Crystallization---female egg containing the germ---nature of impregnation unknown---most probably affected by absorption---the propagation of polypi—causes of monstrous productions---of hermaphrodites---of the resemblances of children to parents---of marks on children from imagination.

LETTER LXII.

An increase of life the effect of death---Animal and vegetable substances resolved into elementary particles by putrefaction---its process described---no destruction of matter---its first substance unknown---fire diffused through all nature; a principal agent in vegetable and animal life---Life not to be confounded with motion, or organization---its first principle immaterial---the regulated vicissitudes of living nature only explicable on theological principles---mischievous effects of fanciful hypotheses and false reasoning.

LETTERS
TO A
TRAVELLER
AMONG THE ALPS.

LETTER LI.

WE now come to less elevated contemplations, than those in which we have recently been engaged, though at the same time they are unquestionably of importance, whether considered physically or otherwise. In our former inquiries, I endeavoured to impress you with the conviction of an opinion, which I own, I have long entertained, and which I have endeavoured to establish on plain, rational, and, I am almost tempted to say, on self-evident principles, that this earth has sustained one, if not many revolutions. The vicissitudes, indeed, are too indelibly marked on its surface, to be denied. The bowels of the earth also contain those coals, bi-

tumens, and other vegetable fossils, whose strata are too exactly identified, to allow us to suppose, that they have been any other than parts of the external coating of the globe, or at least of the bottom of the ocean. The summits of the Imaüs, of the Alps, and of the Cordelliers, prove, that those mountains were, in former times, covered by the waters; and that ancient continents, whose lowest plains must have been of greater elevation than their most towering eminences, must have stretched themselves along the Pacific and the Atlantic oceans. At what time things were in this situation I do not presume to say; for me, it is sufficient to believe the fact; and in such temper of mind, that I view the whole system of nature as a grand museum, and the properties of its contents as a fit subject for investigation. In such pursuits as these, it is, that the human intellect asserts its native dignity, and maintains the ascendancy which it possesses. Every subordinate species of being acts contented in a lesser sphere, and performs the part assigned it, with instinctive quietude: but, man contemplates the things around him, surveys, examines, and admires. His capacity is adapted to complex inquiries: he is not satisfied with the bare inspection of facts; he marks effects, and dares to ask the cause.

All

All beings in the universe may be arranged under three heads. First, *physical*, which are material, or palpable objects of sense, which may be seen, felt, and heard; as the phænomena of the fossil, vegetable, and animal kingdoms, together with those of the planetary worlds. Secondly, *metaphysical*, or objects of the intellect or understanding, which are neither seen, felt, nor heard; but are to be conceived and understood. Thirdly, *moral beings*, a compound of both, being partly objects of sense, and partly of the understanding. Thus, of all the sciences, natural philosophy as the general parent, deserves the first place. Natural philosophy is the trunk of the tree of knowledge, out of which, and in proportion to which, like so many branches, they all grow. These branches spread wide, and bear luxuriant fruits of different kinds. And hence it is that such delight results from the cultivation of this science. For upwards of a fourth part of the whole age of the world, indeed, agreeably to the Mosaic computation, the power of one great man's mind, but not with experiment for its foundation, reigned paramount over the human understanding. This man was Aristotle. But, however justly he was entitled to admiration, it cannot be denied, that his principles of natural philosophy were established upon less firm

grounds, than that upon which physical science is built at present; and that his modes of reasoning were less calculated to produce real knowledge, than those are, which owe their being to more minute inquiries and observation. The present century, perhaps, yields the fullest blaze of light, that ever shone on philosophical pursuits. No *ipse dixit* now fetters us in the shackles of prejudice. Each man penetrates the walk of science more peculiarly suited to his genius, and contributes his part towards enlightening the world.

The real state of things points out the inconceivable power of the God of nature. What a diversity in plants! What a diversity in animals! Is there any country entirely barren of useful productions? Or any season of the year without its fruits? Where is the spot of ground so small, as not to demonstrate the extent of the plastic power? Amid the thousands of millions of blades which compose the mosses of the fields, how few that perfectly resemble each other? In regard to animals, their variety exceeds conception. It is infinite with respect to figure, form, disposition, and manner of living. From the microscopic mite, to the towering elephant, there is an imperceptible gradation in the size of animals, and each gradation is composed of

of a multiplicity of species, all of which differ in their motions, and are furnished with different arms. In each gradation, there are terrene and aquatic animals, and those which fly, and those which skim along the air. There is the frugiferous race, the carnivorous, and the mixt. Nor are there any, whose shape and make is not particularly adapted to the place they are destined to inhabit, and the kind of life they are appointed to follow. All are endowed with some particular talents; and those who have the same qualities, differ, notwithstanding, in the manner of possessing them. Is strength or agility the characteristic of an animal? In one it is seated in the ribs; in another in the vertebræ; in one in the wings; in another in the hams; in one in the neck; in another in the jaws. Some, again, are distinguished by the exquisite delicacy of the senses. In this animal it is centered in sight; in another in hearing; in a third in smell; and in a fourth in feeling. Again, how great the difference in the arrangment of the brain and nerves of birds and of quadrupeds; betwixt the structure of the lungs in the terrene and in the aquatic race. The intestines of bipeds and quadrupeds are composed of distinct pieces, all of which have their particular shape and mould. In reptiles and insects it is one entire bag or canal,

that commencing from the head, terminates at the tail. In the testaceous race, that cling to rocks and rugged parts of the earth, the bones cover the flesh: whereas in every other species, the flesh envelopes the bones. But, that part of animals, where the greatest variety is observable, is the organ which serves to gather their food. Here every animal receives a different mould, according to the element he inhabits. Those that live upon the earth and in the waters, and those which frequent the air, have each of them this organ differently formed. It is by this that the frugiferous animals are distinguished from the carnivorous; not only among the quadrupeds, but also in birds and fishes; not only among animals visible to the naked eye, but among those which the microscope discovers. What an apparatus of saws, levers, pinchers, hammers, and other offensive weapons, are observable in the forehead of some animalculæ, while that of others is perfectly smooth. By this organ, also, are the species that live upon the roots of plants distinguished, from those that brouze upon the tender herb.*

In this sort of philosophy then there is a double pleasure; first, that of admiration, whilst we contemplate

* Anim. Creat.

contemplate things that are great and wonderful, and yet do not understand their causes; for though admiration proceeds from ignorance, yet it is attended with a kind of delight peculiar to itself. Secondly, the intellectual pleasure of distinct knowledge and comprehension, when we come to be possessed of the key that unlocks those secrets, and see the methods wherein those things come to pass, that we admired before.* Man in general, to be usefully informed, needs not soar into infinity; nor puzzle himself with combining the several advantages and inconveniences of possible worlds. That knowledge is perhaps the most valuable, which is the most plain and demonstrative. Nor can we employ our time better than in the consideration of such objects as surround us, and in which our own interests are immediately concerned.

Naturalists have divided all bodies into three kingdoms; mineral, vegetable, and animal. Minerals, as we have seen, are those unorganized bodies, the size of which is augmented by being placed near to each other; or by crystallization; and which obey the laws of attraction and combination. Vegetables are formed of fibres and vessels, which contain their fluids. They are

* Burnet:

nourished by the elaboration of their juices. They obey the laws of generation, digestion, nutrition, and secretion. They have also the properties of respiration and irritability. Sensibility does not seem to belong to them: they are fixed to the soil upon which they have grown, and there they perish. Animals enjoy most of these properties, and in a degree more strongly marked. Circulation, respiration, irritability, sensibility, and loco-mobility, form their distinct characteristics. Their organization is more complicated, and more elegant, than the organization of vegetables. The limits of the vegetable and the animal kingdoms seem confounded in their extremes; as, for example, in the *polypi*. At the same time, there are classes of animals, particularly those of the shell tribes, whose movements are so extremely slow, that they are generally, though erroneously, supposed to be fixed to the spot, like vegetables, and to live and die on the same soil. And on the other hand, there are certain vegetables which have an astonishing degree of motion, and whose organization appears to be, if possible, more perfect than that of the Zoophytes. This, indeed, renders classification difficult. Nevertheless, there seems so be an essential difference between a perfect animal and a perfect vegetable. In the one, the organs are more multiplied; the

structure

structure is more complicated, and the functions are more numerous and more extended. Moreover, animals appear to have a faculty necessary for the preservation of their existence. They reproduce their kinds by cohabitation. One class, by the union of the sexes, generates little living animals; another lays eggs, which require nothing but the incubation of the sun, or parent. But at the same time, it must be confessed, a third seems to perform a solitary multiplication; and a fourth may be propagated, as trees and plants, by shoots and engraftment.

"Man," says an eminent physician, * "is an animated automaton, or a most complex natural engine of the hygraulic kind, including all the powers of nature, mineral, vegetable, animal, and intellectual, employed in the offices of nutrition, sensation, muscular motion, and propagation." The mineral powers of nature are employed in the bones, teeth, and alternate appositions of matter to the solids. The vegetable, in the hairs, nails, cuticle, consistent and motive parts, in the productions and reproductions of the vessels, and the cellular cobweb-like fabric of which they are formed. The animal, in causing motions in the muscular fibres, and giving sensations to the intellectual

* Haller.

intellectual mind, by impressions of a nervous fluid, in a manner which the Creator has thought fit to conceal from us. Man is indisputably the first in the class of terrestrial existencies. At the same time, we find in animals the same principles as in vegetables, though differently combined and qualified. The basis of their substance is earth, most distinguished in the bones, the ashes of which are not fusible in fire, nor capable of running into glass. Of the fluids of the body, water is the principal ingredient. When blood is set by to cool, it separates into a lymph or serum, very little differing from water, and almost insipid; the remainder is a coagulated mass, consisting of the red globular particles of the blood, which are composed chiefly of earth, and when distilled to dryness, may be reduced to ashes. The inflammability of animal oil, or fat, shews that fire is fixed in it; and the production of that remarkable body, phosphorus, which is made from putrified animal juices, is another proof, that fire is an ingredient in the animal frame. The vapour which rises from the body in perspiration is a farther proof of this; because water never becomes volatile but from a mixture of fire. The vapour which rises from the intestines of an animal newly killed is so inflammable, that it hath been frequently observed to take fire at

a candle. When it putrifies, a large quantity of fixed air is disengaged from the body of an animal. The four usual elements, therefore, are the ingredients which discover themselves, when the human body is decomposed. The bones are elementary earth; the blood is a red earth, floating in an insipid water, as its vehicle. The vital motions are maintained by the heat of an internal fire; and the breath of life is the element of air. *

On this, as on one of many grounds, stood the whimsically supposed similitude between the microcosm and the macrocosm. For instance, every thing taken as nourishment by man, is by the interior alchyny, it is said, formed into different substances. The excretions afford no indications of a formerly salubrious nourishment. The good has been taken, and the unuseful expelled. Thus, in like manner, the æther, the air, the water, and the earth, take to themselves that which invigorates, and is wholesome to their bodies in the aggregate. The æther attracts to itself the lower vapours, which are prepared and subtilized, and which are to replace its incessant expenditure. Of these, however, it takes only so much as it finds beneficial, and the superfluity

* Jones.

superfluity it discharges into the inferior atmosphere. The air, after it has satisfied its coarse, and in general undistinguishing appetite, throws off the residue in rain and dew into the waters. The waters follow the same steps, and discharge their superabundance upon the earth And the earth, in its turn, when overloaded, or injuriously supplied, casts forth its foulness, and sends it in fresh circulation in vapours, exhalations, in fogs and in smoke. Thus, the whole universe, or the macrocosm, acts in a manner analogous to the microcosm, or man.

Physiology ought not to be confined to the consideration of man alone. The functions of all animals ought to be considered; and as living machines, they may be reduced to the following. 1. Circulation. 2. Secretion. 3. Respiration. 4. Digestion. 5. Nutrition. 6. Generation. 7. Irritability 8. Sensibility. These functions are to be discerned in almost all animated beings. Circulation is one of the first functions. It is that which supports life. When it ceases, the animal dies. The organs of circulation are, the heart—which is a hollow muscular organ, of a conical shape, and which consists of four cavities, the two largest *ventricles*, and the two smallest *auricles*—the arteries, and the veins. The

blood

blood in this circulation is, by the supposed exertion of the immense muscular power of the heart, injected into all parts of the body by the arteries, whence it is brought back to the heart again by the veins. All the veins discharge themselves into the ventricles of the heart, whence all the arteries arise. The blood expelled out of the right ventricle, must be carried through the pulmonary artery into the lungs, from which it must be returned by the pulmonary vein to the left ventricle. From the left ventricle, the blood thus imported is, by the construction of that part, again expelled into the aorta; by it distributed all over the rest of the body, and thence is returned to the right ventricle by the *vena cava*, which completes the circulation. The space of time, wherein the whole mass of blood ordinarily circulates, is variously determined; seven or eight times, perhaps, in the hour. The weight of the whole mass of this fluid is computed not to exceed twenty four pounds: * although, wonderful to be conceived, it requires a weight or force, for the production of the circulation, of one hundred and thirty-five thousand pounds. † The velocity of the motion is seventy-eight feet in a minute. ‡ Five hundred pounds weight of blood, are calculated to pass daily through a man's heart;

* Fourcroy. † Borelli. ‡ Keill.

heart; and the heart is said to have one hundred thousand, eight hundred pulsations, in the course of twenty-four hours. The particles are tenuous, to an almost inconceivable degree. A red globule is twenty-five thousand times *less* than the smallest grain of sand.* And yet this blood has always been considered as the focus of life. The difference of temperament, with regard to the passions, has been attributed to it by almost all philosophers. Even physicians have ascribed to its alterations the cause of almost every malady.

In quadrupeds, in birds, and in the cetaceous tribe of fishes, this function is performed as in man. In fishes, in general, the heart has but one ventricle, and the lungs do not receive the blood from any particular cavity of the heart. In reptiles, it is the same as in fishes. Insects and worms have their hearts formed and contained in a series of knots, which are contracted one after the other. Their vessels are very small. Their blood is cold, and without colour. The polypi have neither heart nor vessels; and they are even probably less perfect than vegetables in circulation.

Secretion

* Lewenhoek.

Secretion is the process, whereby the several juices or humours of the animal body are separated from the blood, by means of the glands. As a bit of waste paper, which is composed of filaments connected together, being once imbued with water or with oil, will not suffer any other liquor to pass through it, but such as it was saturated with before: as pieces of cloth or cotton, likewise imbued with oil or with water, and dipped in a vessel of oil or of water, that which was saturated with water will suffer nothing but water to pass through it, and that which was saturated with oil, will suffer nothing but oil to pass through it: thus, in the secretory vessels of the glands there is to be found a similar structure, an interwoven mass of filaments, though disposed a little differently, which will suffer no juices to pass through them, but those with which they had already been saturated. The blood is not an homogeneous fluid; it is composed of different molecules, oily, mucilaginous, watery, subtile, and grosser saline particles. These all are filtrated by the glands into the arteries, and each betakes itself to its appropriated situation. *

In

* Fourcroy.

In all beings in which there is circulation, secretion follows the same laws it does in man. It even appears to do the same in those animals who have not hearts. Many creatures, however, have secretions which men have not, such as musk and civet in quadrupeds, spermaceti in whales, the oily substance allotted to the use of the feathered tribe, the virulent humour of the snake, and the sharp acrid juices of many reptiles and insects.

Respiration is used in propelling the blood from the right to the left ventricle of the heart, thereby to effect circulation: whence it is that persons strangled or drowned so suddenly die; that is, from the stoppage of the circulation of the blood; and whence it is that animals expire so quickly in the air-pump. Without respiration, the blood turns putrid and pestiferous: and yet the fœtus is exempted from the necessity of respiration. Quadrupeds, the cetaceous tribe, and birds, respire as man, by the lungs; fishes, reptiles, and insects, by variously formed organs. The lungs of man are divided into five lobes, three of which lie on the right, and two on the left side of the *thorax*, or chest. The substance of the lungs is chiefly composed of infinite ramifications

mifications of the *trachea*, or wind-pipe, which, after gradually becoming more and more minute, terminate in little cells or vesicles, which have a free communication with one another. At each inspiration, these pipes and cells are filled with air, which is again discharged by respiration; and thus is kept up the circulation of air, which is necessary to existence.

Digestion, is the separation of the nutritious milky fluid, called chyle, from the food, and its absorption by particular vessels, called *lacteals*. The principles of this chyle seem to be sulphurous, mucilaginous, saline, and aqueous; it is a kind of natural emulsion. Chylification commences by comminuting the aliment in the mouth, mixing it with saliva, and chewing it with the teeth. By these means the food is reduced into a kind of pulp, which being received into the stomach, mixes with the juices of the stomach, and there diluted, ferments and attenuates, and assuming a very different form from what it had before, becomes acid and acrimonious. In this state, it meets with a juice, separated from the blood by the glands of that part, whose excretory ducts open into the cavity of the stomach. By the commixture of these liquors an essential menstruum is composed, by

which the parts of the aliment are still more and more divided, and acquire still a greater affinity to the animal fluids. The stomach, by means of its muscular fibres, contracting itself, gradually discharges its contents by the *pylorus* into the *duodenum*, in which vessel, after a small semicircular descent, it meets with the pancreatic juice and bile, both of which combining with it, the aliment is still rendered more fluid by the disjunction of the grosser parts from the more pure; and here the chylification is perfect. The contents of the intestines are moved on by the peristaltic motion, until all the chyle is entirely absorbed; that which remains is merely excrementitious, and is destined to be thrown off *

This explanation of the process of digestion was long looked upon as irrefragable. Spallanzani, however, has lately proved, by innumeable experiments, that digestion is unaccompanied by putrefaction; and further, that the stomach is provided with an antiseptic principle, and that the *gastric* juices are at once the solvent, and the preservative from putrefaction. "If by any accident, for instance," says he, "putrid food should get into the stomach of some

* Foureroy.

some animals, they are subject to vomiting and other bad symptoms, and even to death itself. While, on the other hand, it is certain that many animals delight in corrupted substances." Thus while some fly the miasmata that arise from bodies in such a state, others seek and are guided by them to their abominable repasts. In health, putrefaction never attends digestion. These proofs, however conclusive, will not, I know, avail with those, who establish it as an axiom, that wherever there is heat and moisture, there must be fermentation; and think that it must necessarily, therefore, take place in the food, and not only in the stomach and intestines, but in the chylifirous and sanguinifirous vessels. They, indeed, limit their doctrine, so far as to say, that, whereas out of the body, it goes on rapidly; in the body, its advances are slow, weak, and generally imperceptible. "Let me entreat these learned and zealous advocates for fermentation, however, to reflect," says Spallanzani, "that my experiments are not directly repugnant to theirs: I only pretend to shew, that not the smallest sensible fermentation takes place in the stomachs of animals or man. With respect to insensible fermentation, as it is among uncertain things, sound logic forbids me either to admit or to reject it."

The antiseptic virtue of the gastric fluid is not problematical. Food, though putrid, must be totally changed before it is turned into nutriment, and is animalized. From experiment it appears, that putrid substances can be restored by the gastric fluid. The antiseptic power of the gastric fluid, therefore, of animals who delight in putrefaction, is probably greater and more efficacious, and consequently can more readily and completely correct putrefaction. This power, indeed, seems to be of a singular kind. Other substances, possessing this quality, while they keep away putrefaction, preserve or restore the cohesion of the parts; whereas, the gastric fluid, being at once an antiseptic and solvent, while it prevents or corrects putrefaction, reduces bodies into very small particles. Yet, what the real principle of this animal fluid is, is not ascertained. * And that which renders it still more extraordinary, is, that animals possessed of the living principle, when taken into the stomach, are not the least affected by the powers of the stomach, so long as the animal principle remains; and hence it is, that we find animals of various kinds living in the stomach, or even hatched and bred there: but the moment that any of those lose the living principle, they

* Spallanzani.

they become subject to the digestive powers of the stomach. *

Quadrupeds differ much in the form of their stomach and intestines, as well as in the form of their teeth. But, what is most striking, is the peculiarity noted by Aristotle and Galen, that there is an invariable correspondence between the number and the position of the teeth, and the form of the stomach. Birds, likewise, differ in the formation of the stomach. Fishes have a membranous stomach; their intestines are generally short; they have a liver, but no pancreas. Reptiles present the same structure; their stomachs distend in an astonishing manner. Insects have a stomach and intestines well organized. Worms have irregular stomachs. The polypus seems to be nothing but stomach; the same opening serving as the mouth and as the aperture of ejection. †

In regard to chylification in general, its operation may be supposed in the following manner: In birds with muscular stomachs, trituration disposes the food to be digested, but the digestion itself is the effect of the juices alone, with which the stomach abounds. Birds with

* John Hunter. † Fourcroy.

intermediate stomachs, or such as are not properly muscular, that is, provided with thick strong sides, as the gallinaceous; or not merely membranous, that is, very thin, as in birds of prey and man, but have an intermediate degree of thickness and strength—these birds, as crows and herons, have their digestion from the gastric fluid alone. Animals with membranous stomachs, a class so numero s and various, that it almost comprehends every family of living creatures; fishes of the salt and of the fresh waters; the amphibious tribe; reptiles, quadrupeds, the cat, the dog, the horse, the ox, birds of prey, and finally man himself. With some of these, indeed, previous trituration is necessary, as in the ruminating order, and in man: in them, it is produced by the teeth, as by the muscles of the stomach in the gallinaceous fowls. But, in others, as in the frog, the neut, the serpent, and birds of prey, it does not at all contribute to digestion. But, in the latter, as in the former cases, the food is dissolved and digested by the gastric fluid. Thus the principle of Boerhaave, and of other ingenious naturalists, who have held fermentation and putrefaction to be in the stomach, is palpably erroneous. Pringle, and Macbride, looked upon digestion as a process merely fermentative. But, in their artificial experiments, they

they neglected making use of the gastric fluid, the most powerful agent in the whole process of digestion.* Not universally, indeed, for though the gastric fluid, for instance, of the dog, be capable of dissolving hard bones, and even balls of ivory, yet, in equal times, very little impression is made upon potatoes, parsnips, and other vegetable substances. Ruminating animals, on the contrary, such as the sheep and ox, quickly dissolve vegetables, but make no impression upon animal bodies. But, the gastric juice of the human stomach, is the very powerful one I particularly allude to, as it is capable of dissolving, nearly with equal ease, both animals and vegetables; no inconsiderable proof that nature intended us to feed promiscuously upon both. †

Nutrition, is the consequence of digestion and circulation. The solids losing constantly from the motions they excite, must be repaired; and this they are by nutrition. Each organ nourishes itself by a matter proper and appropriate, which it separates; for instance, the muscles nourish themselves by a fibrous matter, which they extract from the blood; while the bones extract a phosphoric calcareous salt, and a lymphatic substance, with an earth. Generation is

* Spallanzani. † Smellie.

variously carried on. The greatest part have need of being coupled, such as men, quadrupeds, and cetaceous animals. The male of birds has a genital organ, very small, without a cavity, and often double. Among fishes there is no decided contact: the female lays her eggs, the male passes over them, and darts on them the seminal liquor. Reptiles are oviparous. Insects offer all the varieties that are to be found among all other animated beings. Even more, for the *puceron*, or vine-fretter, is both viviparous and oviparous; the former in the summer, and the latter in the autumn.* And the *pediculus*, though extremely prolific, has never, on dissection, been found without an ovary, nor ever with the organs peculiar to the male sex.† Worms are of both sexes, and the contact is double. With respect to the generation of the human species, this is not so clear a point, as we shall have presently occasion to observe. The male seed, however, has been supposed to have been received into the womb of the female: the female seed, also, has been supposed to have been destined to the same situation; where both joining, they together contribute to the formation of the fœtus, which is either male or female, as the seed of the man or the woman abound most with organic molecules.‡

Irritability,

* Bonnet. † Swammerdam. ‡ Fourcroy.

Irritability, is the property which certain organs, called muscles, possess; to contract or to shorten themselves by the action of whatever stimulus touches them. The muscles of men, quadrupeds, cetaceous animals, and birds, resemble each other. Those of fishes differ, and are more irritable. Among reptiles, the irritability is still stronger, and so tenacious, that it remains long after they are dead: a peculiarity, indeed, which seems common to all animals, whose blood is cold, while those whose blood is warm, lose the property of tenacity in proportion as they cool. Insects have their muscles placed in the interior of their bones, which are hollow, and are of the nature of horns. The muscles of worms, and of polipi, are extraordinarily irritable. It is irritability which gives animals the power of motion, and that of transporting themselves from one place to another.

Sensibility, is that function from which animals experience pleasure and pain, but as being less mechanical than the rest, it is of course entitled to a more particular investigation. Of animated substances, therefore, in general, we may say, that the bodies of the principal animals, that is of man, and of quadrupeds, are formed of solids and of fluids; and that the humours,

mours (for I have no better term) are divided into three classes: the first contain the incremental humours, destined to nourish certain organs; the second comprehends the excremental humours, which are ejected by the body as useless, or even injurious if retained too long; in the third are placed those humours that partake of the other two, the one being recrimental, and the other excremental; as for instance, the lymph, the gelatinous juices, the fibrous juices, the fat, the marrow, the matter of perspiration, and the boney particles; and on the other hand, the fluids of transpiration and of perspiration, the mucus of the nose, the wax of the ears, the gum of the eyes, tears, urine, and other excrements. But, above all, the saliva, the bile, the pancreatic juice, the gastrical and intestinal fluids, the milk, and the seminal liquor. To these we may add the most important, the most compound, and perhaps the most incomprehensible of all, the blood. This many have conceived to be a fluid flesh, as I have already said—others, a living substance; but, neither one nor the other is as yet completely demonstrable. This fluid differs much in different regions; it is not the same in the arteries, in the veins, in the breast, or in the lungs, in the regions of the liver, in the muscles, and in the glands,

glands. Men, quadrupeds, and birds, however, have the blood warmer than the temperature they inhabit, and therefore they are called animals of warm blood. Fishes and reptiles are of an equal temperature to that in which they exist, and therefore are called animals of cold blood. While the blood of warm-blooded animals continues warm, it continues fluid; when it cools, it becomes solid. Viewed by a microscope, blood appears composed of numerous red globules, swimming in a transparent fluid. Physicians observe, that an excess of blood produces plethora, lethargy, and other diseases; that its too rapid motion occasions fevers, and that from its viscidity and languor, proceed fatal obstructions. *

What a variety of springs, of powers, and of mechanical movements are thus included in that small portion of matter of which the body of an animal is composed! yet, the greatest miracle is in the successive renovation and duration of the species. We exist without knowing how; we think without perceiving the cause of thought. Matter is as a foreign covering, united to us in a manner unknown. † *Thought* is the constituent principle of our being, and is entirely independent

* Fourcroy. † Buffon.

dependent of matter: yet, it is astonishing how man has been classed by some philosophers. He is an animal, indeed, say they, because he is neither a stick nor a stone. He is not a worm, because he does not crawl. He is not a fish because he has not fins. He is not a bird because he has not plumage. What is he then? Why he is a quadruped; he has four feet; two to feel his way, and the other two to follow: he is little better than an ourang-outong. It is true, he is not generally covered with hair; but, this has arisen from accident, or from culture, and does not destroy the original distinction of nature. What, for instance, is the great difference between the skeleton of a horse and that of a man? "Take the skeleton of a man," says Buffon, "incline the bones of the pelvis, shorten those of the thighs, legs, and arms, join the phalanges of the fingers and toes, lengthen the jaws by shortening the frontal bones, and, lastly, extend the spine of the back. This skeleton will no longer represent that of a man; it will be the skeleton of a horse." Raise the skeletons of quadrupeds, from the ape kind to the mouse, upon their hind legs, and compare them with the skeleton of a man, the eye will instantly be struck with the uniformity of structure and design observed in the formation of the whole group.

In a philosophic light, indeed, we may look upon the animal man as a quadruped, or as a biped. We may consider him as a reptile, because he mines under ground; we may consider him as a water animal, as an aerial animal, or as a terrestrial animal; for through any of these elements he can make his way. But, if we take that stand which is alone compatible with common sense, we shall acknowledge that man is placed on the confines between different kinds of beings; and as the zoophyte is in the middle, between the animal and the vegetable; so man appears to occupy the space between the first of the classes of animals, and the last perhaps of a more perfect chain of existencies.

Man is composed of two parts, soul and body. The body of man forms an admirable machine on hydraulic principles; we discover in it innumerable channels with fluids, so many, indeed, that it seems almost entirely to be composed of them. All the parts of the body communicate one with another, by nervous ramifications. In a living animal, the nerves only, and the nervous productions, are the seat and organs of motion; for, as in voluntary motions, the nervous fluid is subordinate to the soul, and becomes the instrument she uses in performing them;

them; so in involuntary motions, the nervous fluid is the principal agent, and combined with the various organs which it animates, performs independently all these motions. The body is sensible; irritability is a property of nervous fibres. Sensations are communicated to the mind by nerves. The immaterial part, in general, commands; but, it is not always the mover of our bodies. The nervous fluid is secreted from our other fluids. It serves both to the motion of our organs, and to the nourishment of the nerves. It is likewise the source of strength to the whole frame: the animals in which it most abounds being possessed of the greatest degree of strength. It is incessantly dissipating; it is exhausted by action, and likewise by rest: for we perceive our strength to fail after fasting, though in a state of perfect inaction, in the same manner as after violent exercise. A nerve, like the substance of every small tube, is composed of many other smaller tubes, which are formed of elementary fibres, or fibres without a cavity. And the only part which has solidity, is the coat it receiyes from the membrane of the brain. The origin of the nerves is in the meninges; but, this is not always derived immediately, for the origin of the nerves in the brain is extremely small, and, on the contrary, their divisions are extremely

extremely large and numerous. Some originate from the medullary substance; others from the medulla oblongata; and others, again, from the spinal marrow. *

The membranes which supply a coat to the spinal marrow, are a continuation of the meninges, and give rise to the nerves of the lower parts. Of this there are proofs; for in all animals, if a transverse section of the medulla spinalis be made, a paralytic affection of all the parts situated below that section, immediately follows, and the mind no longer receives any sensations from those parts. Luxations, whereby the spinal marrow is compressed, are attended with the same effects. If the membranous productions of the brain be divided, or that part whence they send off a coat to the medulla oblongata; or even be fixed tight with a ligature, the whole body of the animal is instantly without motion, and the mind is deprived of sensation, the head only giving some faint signs of life. In the palsy, the limbs successively lose their motion; the extremities become insensible; death steals on the trunk, marking his course on every part he passes over, until scarce any signs of life are perceived, and those are left in the *head* only. These observations,

* Essay on Man.

tions, if they do not precisely mark the seat of thought, at least shew that we are to look for it no where but in the head. To these proofs, also, may be added our feelings: every one who thinks intensely, perceives a kind of tension within his head, and that his ideas are formed within that organ. But, what part of the head the seat of thought possesses, it would be futile to inquire. Some place it in the *pineal gland*; others in the *corpus collosum*; others in the *cerebrum*; some in the *cerebellum*; and some in the *meninges*. The last, indeed, if there be a preference, seems the most probable, for if we trace the nerves to the entrance into the membranes of the brain, we shall find they confouned themselves with the meninges, and form one simple, uniform substance with them. The meninges are the dura mater and pia mater. The substance of the cerebrum and cerebellum may be taken away from the living animal, without producing an instantaneous effect upon the mind. Whereas the slightest inflammation of the meninges, occasions a delirium, and a temporary insanity. The irritation of the nerves by the fumes of wine, is followed by the irritation of the meninges, and the loss of reason. There is, then, the strongest reason for supposing

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that this membrane is the immediate seat of sensation. *

This nervous power, by which all the actions of the human system are supposed to be effected, is an incomprehensible phænomenon. What it is—whether it be a fluid that, by certain fluctuations in its own substance, produces these effects, or whether it be the vibration of chords like musical strings—cannot be determined. Whatever it be, it is surprisingly active, and may be compared to that ætherial matter, that subtile fire or electricity, which we have had reason to believe prevalent in the general laws of nature. "The opinion," says Buffon, "that the brain is the fountain of sensation, and the center of all sensibility, was so simple and so natural, that the *physical impossibility* which it implies, though abundantly evident, was never attended to. How can an insensible part, a soft inactive substance, such as the medullary part of the brain, be itself the instrument of all sensation, and of all motion? How can this soft, insensible substance not only receive impressions, but retain them for a long time, and propagate vibrations through all the solid and sensible parts of the body? What, then, you will ask, is the use

* Essay on Man.

of the brain? Is it not found in every animal? When compressed, is not all motion suspended? If it be not the principle of action, why is it so essentially necessary? These questions admit, however," continues Buffon, "of easy solutions. Upon examination, the brain, as well as the medulla oblongata, and spinal marrow, which is a prolongation of the brain, are only a species of mucilage, and hardly organized. The nerves never penetrate the substance of the brain; they terminate on its surface. The brain furnishes nutriment to the nerves, which ought to be considered as a species of vegetation, issuing from the brain in trunks and branches, which afterwards divide into an infinite number of ramifications. The brain is to the nerve, what the soil is to the plant. The brain, therefore, instead of being the organ of sensation, or the principle of sentiment, is only an organ of *secretion* and *nutrition*, but a very essential organ; for without it, the nerves could neither grow nor be supported. Animals, and children, have been born without head or brain, and yet they had motion and life. There are whole classes of animals, as insects and worms, in whom the brain is not perceptible, having only a part corresponding to the medulla oblongata and spinal marrow. It is, therefore,

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more rational to place the seat of sensation in the spinal marrow, which no animal wants, than in the brain, which is not an universal part, common to all sentient beings." * "But, in man, and in the animals, which resemble him, the *diaphragm*," proceeds Buffon, "appears to be the center of sentiment. It is upon this nervous part, which conveys the impressions of pain and pleasure, that all the movements of the sensible system are excited. The diaphragm makes a transverse division of the body into two equal parts, the superior of which includes the heart and lungs; and the inferior, the stomach and intestines. This membrane is endowed with such an extreme sensibility, and is so necessary to the propagation, and the communication of feeling, that the slightest wound is always accompanied with convulsions, and often with death. The brain, therefore, which has been considered as the seat of sensation, is by no means the center of sentiment, for it may be wounded, and even parts of it cut away, without destroying the animal. Sensation, therefore, ought to be distinguished from sentiment. Sensation is only a vibration, or impression on the sense; but sentiment is the same sensation, rendered agreeable or disagreeable. Its essential characteristic is

* Buffon.

pleasure or pain; each of which is felt in the region of the diaphragm.

Lively genius, and brilliant imagination, are often too apt to lose their way in their journeying through philosophy. At first, supported by a few leading facts, they feel bold, and push on, as on the sure road. A cross turn meets them, they then are obliged to alter their course, and eventually perhaps have nothing but conjecture and hypothesis to guide them the rest of their way. But, though there should be contradictory phænomena, I would not dissuade the inquisitive mind from such curious, if not advantageous excursions; particularly, as there is no branch of inquiry which is secure from illusion, or exempt from controversy. Whether the brain be the radix, and the diaphragm be the plexus of the nerves; or whether the one be the soil, and the other be the seat only of the vegetable ramifications; I confess myself incapable of determining. One thing, however, is certain, that the stomach sympathizes with every part of an animal, and that every part sympathizes with the stomach; therefore, whatever acts upon the stomach, and rouses its natural and healthy actions; and whatever affects it, so as to produce debility, has an immediate effect upon every

every part of the body. This sympathy is strongest in the vital parts. Besides this universal sympathy between the stomach and all the parts of the body, there are peculiar sympathies: for instance, the heart immediately sympathizes with the lungs. If any thing be received into the lungs, which is a poison to animal life, such as inflammable air, or volatile vitriolic acid, the motion of the heart immediately ceases; and from experiment it appears, that any thing salutary to life, applied to the lungs, will restore the action of the heart, after it has been at rest for a considerable time. * And thus, whatever the absolute causes of sensation may be, one thing seems clear, that motion inevitably appertains to it, in all its forms; whether, for example, we hear music, or taste savours, or smell odours, or feel a stone, or see light. †

* John Hunter. † Harris.

LETTER LII.

IN the formation and arrangement of the parts of animal bodies, a wonderful and inconceivably various mechanism is observable. But, in such soft and yielding materials, the motive power must be incomprehensibly great, both as to the continuation of the many different motions, constantly going on in the several parts of the body, as the heart, stomach, lungs, intestines; and to the renovation of those motions that are interrupted, and restored by turns, as walking, working, or speaking. In the action of soft bodies upon soft bodies, it has often been demonstrated, that the motion is always diminished. How much then, and how constantly must it be diminished, in the yielding softness of the flesh and fluids of animal bodies? Let us reflect how soon water settles, after motion impressed, by the bare attrition of its parts on one another, although it has no obstacles to encounter, or narrow passages to move through. Motion is easily continued or communicated in free spaces, especially if the moving body be hard

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and firm: but, it is quite otherwise in the veins, arteries, intestines, and lacteal vessels of the bodies of animals; in the narrow twining meanders, which convey the fluids constantly to innumerable parts. The capacity of these slender tubes could not admit the finest hair; and the mazes and windings are to us inexplicably perplexed and intricate. What a quantity of attrition must there be, while the blood, lymph, and chyle creep through these, not even microscopic vessels! No mathematician, yet, hath been able to calculate the attrition of the parts of fluids upon one another, while they move against the sides of such narrow channels, or for their loss of motion, in the constant change of their direction. The power, that urges the fluids in animal bodies ten thousand different ways at once, has never yet had a term of art assigned it by philosophers. It acts upwards, against the nature of gravity. Attraction between the particles of fluids does not help us out. Attraction to all sides would rather stop motion, as it does between the particles of liquors. The alternate contraction and dilatation of the coats of the vessels, is a postulate, which supposes the thing to be explained mechanically; and it is no where applicable but to the heart and to the arteries. It is an attempt as full of

blindnes as of vanity, to offer to account mechanically for the circulation in the animal body. In the womb, we are not only fearfully and wonderfully formed, but we are, every minute after, fearfully and wonderfully preserved. Thus, says a celebrated anatomist, we who attend to dissections, are little better acquainted with the true state of the human frame, than the porters and errand boys are with the politics of the city they inhabit. Like them, we know every street, every alley, every passage; but like them too, we are ignorant of what is going forward in the mansions, to which these passages lead. But, is this mechanism the work of matter and motion? The motion is constantly consumed, and new force is constantly impressed.*

It has been calculated, that when a man extends his arm, and, upon the extremity of his fore fingers, supports as great a weight as he can in that posture, the force that is exerted in the muscles to support this weight, is more than seventy thousand times greater than the weight itself.† What a lever, and what a fulcrum! But, we cannot trace the inexpressible subtilty of this mechanism. Neither are we, *a fortiori*, preposterously

* Baxter. † Borelli.

posterously to give such skill and art to chance, nor such unfathomable wisdom to necessity. The fact is most probably, that the whole body is all over one common sensory, for all perception must spring out of its own nature, or belong to it. The same faculty which ascertains the copy, must as necessarily perceive the original. The action must spring out of the general nature of the active principles themselves. The sensation of a living being, is not restrained to certain bounds.

The animal economy may be divided into two parts, the first of which acts perpetually, and without interruption, and the second acts by intervals only. The action of the heart and lungs in animals which respire, and the action of the heart in the fœtus state, constitute the former; and the action of the senses, joined to the movements of the members, constitute the latter.* To this we may add, that every animal has two modes of existing; sleeping and wakeing. In one, every function of the organs of the body is suspended, except that of the organs of life: in the other, every spring of the machine is, or may be in action. As sleep approaches, the frame relaxes and yields; the mind

* Buffon.

mind likewise partakes of the inchanting stillness, forgets every thing, even itself, and imperceptibly sinks into insensibility. Not, indeed, that the mind becomes inactive; its operations only become less sensible. When the body has been refreshed by rest, the organs of sense insensibly resume their functions; the pulse gradually quickens, the face regains its colour, and by degrees, all those vain images, enchanted regions, and ideal objects, which had been created by sleep, disappear: in fine, the animal, as for instance man, opens his eyes, and is conscious where he is.*

This faculty is of unbounded advantage. Naturally and without restraint, the animal passes from motion to rest, and from rest to motion. The moment of waking returns as necessarily as that of sleeping, and both happen independently of foreign causes. The animal can exist only a certain time in either state. Continued waking, or continued sleeping, would be equally fatal to life. Man, who is pre-eminent in the class of mortal existencies, is born to labour; but, he cannot undertake it, unless by rest his blood be sufficiently supplied with particles of subtile matter, to put the springs of the

* Essay on Man.

the brain, and those of the different muscles of the body, into motion; otherwise the animal would waste and grow languid by the continual dissipation of that matter, so essential to voluntary motion. For this reason, God has given sleep, but, has not left it at man's own disposal. He measures it himself, and has made it an agreeable necessity, without suffering the creature to understand, or to govern it. It is an incomprehensible state, and mankind so little understand its nature, that they cannot command it when it is refused, nor refuse it, when it is commanded. Night obliges man to leave his labour, and rest his wearied limbs, by depriving him of the sight of objects; and by keeping him without action, prevents any impressions that might too strongly affect his mind. She introduces a general silence, deprives him of the images of nature, to take away the use of his senses; and as the latter is of no service without the former, she deprives him of them both. *

The several species of sensation are, first, the *touch*. The fingers, at the extremity of which nerves are branched out in great quantities adapted to the purpose, may properly be called the peculiar instruments of touch. From them we

* Spect. de la Nature.

we receive information of the shape, figure, and extension of bodies, it has even been said of the difference of colours. *Taste*, is not allowed to be so noble a faculty as touch. The exact seat of the taste is in the mouth, but whether it be confined to any particular part of it, or distributed through the whole of this cavity, is uncertain. The tongue is undoubtedly of itself sufficient for the purpose, consisting of a number of small secretory glands, terminating in papillæ, by which it constantly emits a liquid which is capable of dissolving many bodies. Solid substances are not the objects of this instrument. It is necesary they be dissolved and become liquid, before a taste can be observed in them. *Smell*, has a great analogy with taste: this is often so apparent, that they are imagined by some to be the same. But, the fact is, they are essentially different. The one consists of a number of glands, exuding a liquid to dissolve substances; while the organ of smell is a membrane covered with naked nerves, without any glands or ducts. The perception of taste is by liquid bodies; that of smell is by solid bodies; not, indeed, that the latter is insensible to liquid ones, but a solution is not necessary. The use of the *sight*, is in some measure supplied by the touch. Sight contributes to information

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and intellectual pleasure; and without the necessity of positive contact. Light is absolutely necessary for seeing. Light, the mould in which all other figures are cast, or the clothing which covers every part of them; the substance which has no determined shape, form, or construction; the something which cannot without controversy be said to possess either solidity or divisibility, yet which possesses extension in a most eminent degree; and which extension implies solidity, and consequently matter. The instrument of *hearing* is situated at a very little distance from those of the other senses. Motion is entirely requisite to produce any effect upon this organ. In taste, smell, touch, and sight, the necessity of motion is not so apparent. The medium is the air. Sounds are produced from certain bodies sooner than from others. What are the peculiar properties of such bodies, is not very certain. The confinement of air to a narrow and circumscribed space, gives great strength to sound. Witness the natural sounds, whence language derives its origin. * One thing, however, is evident as relative to these phænomena in general, that exterior objects all act on our senses by the touch; contact, if not impulsion, being evidently necessary. In every sensitive being also it

* Farr's Anim. Mot.

it is apparently the same. And hence, may not all the senses be virtually reduced into modifications of one?

If the body be an admirable machine, the *soul* is a substance still more wonderful. It is this invisible agent, which actuates the limbs, and which produces the harmony of motion. It is this which varies the physiognomy, and by turns, impresses on it grace, majesty, fear, meekness, innocence, and love. Without the soul, the body would be like a plant, separated from the soil whence it drew its nourishment; and would perish, notwithstanding its admirable structure, from inability to select the aliments by which the decays of nature might be repaired. Man, therefore, we may safely assert, receives impressions of pleasure and pain, both from objects which act on the body, and from those which are purely intellectual. From the predominancy of these proceed all the happiness and misery of human life. Most sorts of knowledge are given us by the ministry of our senses; to regulate their use is the office of reason. And hence the mind, which is more properly ourselves, is served by the body as the channel of conveyance. For instance, between the little image formed on the retina of the eye,

and the vision of the exterior object in its fullest extent and dimensions; between the vibrations of the air, and the sound which ensues; between the fibres of our brain, or diaphragm, and the ideas which are attached to those fibres, but, which by the aid of our memories, we are able to bring forth at pleasure; between the whole brain, and the immense crowd of images which are attached to the imagination; can the connection be explained by any properties in matter, or by the mere operation of mechanical causes? * By coloured, or by figured atoms? By the flowing of certain particles, or the arrangement or disarrangement of certain other particles? By attraction or repulsion? or by any physical connection, absolutely and necessarily inherent in the nature of things?

Man has not only the active power of beginning and directing motion in corporeal beings, but he has also the higher faculties of perception, reason, volition, memory, and other intellectual operations. The brutal part of the creation consists also of active spiritual beings, capable of perception and sense, and of a lower degree of reason, commonly called instinct. The lower class of animals, inhabiting the airy and watery elements,

* Berkley.

elements, and also reptiles upon the earth, have sensations, and are capable of pleasure and pain; have a power to avoid danger, and to preserve themselves; and a power of self-motion, as well as of that of moving other beings. Some have little more sensation than plants, and are confined like them to particular places. Plants are endowed with an active principle though fixed to the spot, by which their several seeds shoot and enlarge themselves, each species retaining its own form, and propagating its own kind. Fossils, metals, and salts have also a sort of vegetative principle; for what are their several crystallizations, but the effect of a power, when in a fluid state, of attracting each other, and thus shooting into salts of regular forms? But, to descend still lower, there is not one particle of what we call corporeal beings, but what will approach to, or fly from another, and that sometimes with the greatest rapidity; for what else is the power of attraction, cohesion, gravity, magnetism, electricity, elasticity, or fermentation, but, either an active principle in those several atoms of corporeal beings, which exerts its *conatûs* to motion; or from something which proceeds from an active being, which rules over the whole system of nature in infinite space?

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The same force and vigour remains always in the world, and only passes from one part of matter to another, agreeably to the beautifully pre-established laws and order of the God of Nature. The elements of things are different from the things themselves. How dissimilar the seed and the vegetable, the embryo and the animal! "But, still every sense," says Pythagoras, "is derived from its proper element: sight from æther, hearing from air, smell from fire, taste from water, and touch from earth." * These elements, however, are not measured out in the same proportion. Animal sensations, therefore, must be different. How is it to be supposed that beings covered with shells, with flesh, with prickles, with feathers, with scales, are all alike affected by the touch? Or that they who have the hole of the ear narrow, and they who have it wide, those who have the ear full of hair, and those who have a smooth ear, receive sound in the same manner? In regard to the organs of sight, some are extuberant, some hollow, some plain; the images, therefore, must be different; and consequently men, quadrupeds, fishes, birds, and reptiles, must behold things in an essentially different point of view. Smelling must also differ according to the difference of animals. Even we ourselves

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* Stobæus.

have this faculty different at different moments. In like manner, as to taste, some have tongues rough and dry, others moist. When in a fever, or indisposed, do we not experience the difference in a manner perfectly unequivocal? But, as our food elaborated into nutriment, here turns into veins, there into arteries; here into bone, there into sinews, and so of the rest, manifesting a different power, according to the difference of the parts which receive it; and as water, being infused into trees, here turns into leaves, there into boughs; here into fruit, and there into bark; so it is to be presumed, that external objects are differently apprehended, according to the different constitutions of the animals by whom they are received.

But, the soul has a distinct source of intelligence from that of sensation. Thought is as clear and determinate in our ideas, as either solidity or extension. The ideas of outward objects, indeed, have their criteria in those objects. Body is the architype of corporeal ideas. But, intellectual ideas having no sensible architype, have no such criterion. How this difference, and yet this union, between internal and external sense, is effected, God only knows. Yet so it is. But, the same incomprehensibility attends the

cohesion

cohesion of the indefinitely divisible parts of body. Our ignorance, however, does not allow us to deny the union and cohesion of these indefinitely divisible parts. Are we then to deny, *a fortiori*, what is as evident, the union of the soul and body? Leibnitz says, "the harmony or correspondence between the soul and the body is a perpetual wonder: thought, and extended substance, have no connection with each other; they are beings that differ *toto genere*." Yet, this communication between them is not physical; if it were, then the soul could change the degree of swiftness, and the line of direction of certain motions in the body; and on the other hand, the body could cause a change in the series of thoughts, which is in the soul. But, no such effect as this can be deduced from any notion we have of the body and soul. The communication, therefore, must be metaphysical, by means of which the soul and the body make up one suppositum, or what is called a person. But as the eye sees not itself; and if a man had never seen another's eye, nor the image of his own in a glass, he could never have had any notion of what an eye is: so the soul cannot discern its own substance. *

* Clarke.

Solidity and extension we have already found, to be essential properties of matter. These properties are dormant and inactive; and therefore, matter is dormant and inactive. Repulsion and attraction are impressions to which matter is liable, but can be no way concerned in its existence. Solid bodies cannot act upon other bodies by their solidity; nor extended bodies by their extension. Such action must originate in powers extraneous to matter, and not constituting its being. But, what are these powers, and what is the cause of these powers? In return, I ask, what is the cause of fire, and what is the cause of the electric fluid? The internal essence of matter is unknown to us; it is beyond the reach of our senses. Its most striking qualities we know to be impenetrability, mobility, and quantity. Its peculiar nature consists in its capacity of becoming successively different sorts of bodies. * But, for man to presume to say, with accuracy, what the soul is, is a vanity as absurd, as it is unprofitable.

The division of the conceptions of the human mind, as given us by Plato, is that which the mind forms with the assistance of the senses, and those which it forms by itself, without such

* Buffier.

such assistance. This makes the proper distinction betwixt body and mind. Of the first kind are the perceptions of sense, which undoubtedly are the act of the mind, as well as the other; for it is not the sense that perceives, but the mind through the medium of the sense. Νους οραι, νους ακουει, was the saying of Thales. The second is what is called ideas. And these may be subdivided into two kinds; the first, such as are directly and immediately formed from the perceptions of sense: of this kind are our ideas of all natural and artificial substances, and their qualities; and, in short, of every thing without us. The others are, ideas which we form from the operations of our own mind. In this way we come by the ideas of thinking, believing, doubting, in short, of every operation of the mind, and of mind itself. The first class of ideas is produced from materials furnished by the sense; the second arises from the operations of the mind upon those materials. Those of the third, however, are more congenial to mind, and may be said to be of its own growth, being produced from materials which itself furnishes: they are the natural born subjects of the state, not naturalized only, as the others are; whereas the sensations are altogether

foreigners.* The faculty by which the mind operates in conjunction with the body, is known by the name of sense; the faculty by which it operates singly, and without participation with the body, may be called intellect. In the perceptions by sense, the mind is to be considered as merely passive, receiving, like wax, the impressions of external objects: but, in the other mode of operation, it exerts that active and self-moving power, which is the distinguishing characteristic of mind, and furnishes the specific difference between mind and body. †

All our knowledge is ultimately derived from comparison. What is absolutely incomparable, is incomprehensible. Of this there can be no dispute. The existence of the soul is as self-evident as that of God. To be, and to think, are, with regard to us, the same thing. The mind has one mode of perception when we are awake, another when we are asleep; and after death, she will, we hope, perceive in a manner still different. The soul does not sleep when the body sleeps. This staggered even Lucretius. He could not comprehend how memory should be darkened; and yet, a material soul, which he insisted

* Eugenius Diaconus. † Montboddo.

insisted upon, should be still awake. Nor is it to be conceived that some passages of the soul should be left open while the rest are shut; or that one part of a material soul shall sleep while the other wakes. * I grant, what by experience I find in my own mind true, that we have no positive idea of immaterial substance; but this is no more an objection to the belief of an immaterial substance, than it is to the belief of matter. We have no idea of matter, stript of its qualities and accidents. We know nothing of any material beings, but their natural virtues, powers, operations, and sensible effects. But, what that substance precisely is, which we call matter, we precisely know not. Thus, then, in the same manner, that we know matter in its properties, we know spirit in its properties: not what the pure, naked, substance of soul is, but what its virtues, powers, and operations are. We feel in ourselves something which understands, reasons, and wills; which can act freely and spontaneously, which can chuse and refuse, and is the subject of different passions. † Is it more repugnant to demonstration, that the infinite power of God should create an immaterial thinking substance, than that he should create a thinking material substance? To answer this

 affirmatively,

* Baxter. † Bishop Sherlock.

affirmatively would be the extreme of hardiness: and yet this has often been done.

Ask this philosopher what the substance of matter is? He cannot tell. Ask that philosopher what the substance of spirit is? He cannot tell. Yet the principle which thinks, is different from that which is the object of thought. The ideas remain even after the objects vanish; and on them we can reflect with as much precision as if the objects were still before us. Perception, or intelligence, therefore, is clearly a distinct quality, and not a mere effect or composition of unintelligent figure and motion. Intelligence cannot be figure; consciousness cannot be motion. Whatever is compounded, or arises from a series of things, is still only those very things modified. Thus all possible changes, compositions, or divisions of figure, are still nothing but figure; and all possible compositions, or effects of motion, can eternally be nothing but motion. Hence, if there ever was a time when there was nothing in the world but matter and motion, there never could have arisen any thing else but matter and motion: and it would have been as impossible there should ever have existed any such faculty as intelligence or consciousness,

as it would now for motion to be blue or red, or for a triangle to be transformed into a sound. Hobbes, feeling the strength of this conviction, was driven to the prodigiously absurd supposition, "that all matter, as matter, is endued not only with figure, and a capacity of motion, but also with an actual sense or perception, and wants only the organs and memory of animals, to express its sensation."*

In common physics, the primary cause of the most common substance is not to be comprehended. Neither of the light by which we see, nor of the elasticity of the air by which we hear, nor of the fire by which we are warmed. In physiology, we cannot tell what first gave motion to the heart, nor what continues it, nor why we are able to move our arms to the right or to the left, by a simple act of our volition. We cannot comprehend the principle by which our bodies were first formed, by which they are sustained, nor by which they are to be reduced to earth. In short, we cannot look into any one branch of knowledge, but we shall meet with subjects above our comprehension.† And shall we, nevertheless, dare to question the existence of the immaterial faculties of our own intelligence? That,

* Clarke. † Bishop Watson.

That, indeed, which the soul is, is a point put out of the reach of human knowledge: and he who considers how difficult it is to reconcile sensation with extended matter, or existence to any thing that has not existence at all, will feel it most. But, as I have already said, it is past controversy, that we have in us something that thinks: our very doubts about what it is, confirm the certainty of its being. * No anatomical research can fathom it, I must confess; nor have we any microscopes or telescopes, which can assist us in such subtile and internal speculations.

The greatest part of the arguments against the immateriality of the soul, were drawn forth in order, by Lucretius, about eighteen hundred years ago. Subsequent writers have gathered from him what he gathered from others, or gleaned in the wanderings of a poetic fancy; and as they have fallen in with fashionable prejudices, their doctrines have been readily embraced, and easily detailed. The mistake of the Roman arose from the ambiguous appearance of those phænomena in a state of union, which seem at first sight to infer the materiality of the soul, but which, upon a nearer view, are found to

* Locke.

to be very consistent with its immateriality. Lucretius makes it as an argument of the soul's being material, that it does not leave all the parts of the body at once. Here it is to be observed, he makes what he calls the soul to be disseminated through the whole body: but, he neglects to consider, that the appearance which he brings as an objection, agrees better with the contrary doctrine; for, if the sentient in the body be a different substance from matter, it must feel the limbs become gradually incapable of being actuated, as the disorder of the animal mechanism increases; whereas, on his supposition of a dividuous soul, which dies in one limb after another—"Inde pedes, & crura mori: post indè per artus. Ire alios tractim gelidi vestigia lethi"—the limb would be quite void of pain, as if it were cut off, and the man would feel his soul go out, whole and entire, through his throat. This is most adverse to his own principle, even in his own confession; for if the soul were immaterial, or grew with the body, says he, that would have been the case, which is really the case. But, why should the throat be the outlet to the soul? Does an immaterial substance want a passage? *Efflare animam*, is a metaphorical expression. But, he supposed that others might place the soul in the lungs,

lungs, as he did the mind in the middle of the lungs, and as others have done since, in the pineal gland, and in the diaphragm. He fancied also that man had still sense and perception left in the parts of his body, when that which he allowed to be the percipient had left them, and had taken its flight. But, these were not the reasonings of philosophy. *

The chief design and subject of Lucretius's fourth book, *De Rerum Natura*, is to shew the manner in which external objects act upon the senses, and produce perception in the mind. He supposes, that from the surface of all material things, there are continually flying off, thin membranes, pellicles, or similar surfaces. These he calls simulacra, membrana, cortex, et effigiæ. Colours themselves, he makes to be thin coloured pellicles, incessantly issuing from the coloured body, tincturing whatever they fall upon with their own dye. Such tenues, consimilésque formarum effigiæ, cannot be singly observed, he says; but by their constant flux, a number of them may, especially from a speculum, upon wood and stone, where these spectres are shivered and broken. This is poetical. But, suppose, as was the custom among the Romans, bodies

* Baxter.

bodies to be burnt, whence then could come the simulacra luce carentum? The surface of the urn or tomb only could remain. Or suppose the pellicles to have flown off in the night, and it is in the night we see them in dreaming vision; then colours and objects must be seen as perfect in the dark as in the light; and if they fly off incessantly, they must be equally visible while we are asleep as while we are awake. But even this is not enough; it is not enough that these similar surfaces be incessantly emitted from all bodies; it is insisted upon farther, that simulacra are spontaneously generated, which do not arise from body; that these keep floating up and down in the air, still changing, until by odd combinations they make up the shapes of giants, monsters, and wild beasts, pretty much in the same manner that we see strange figures compounded in the clouds: and hence, the surfaces arising from the bodies of a man and horse, by sticking together, made in former days the simulacrum of the centaur.*

Organic and adventitious particles, with all the elaborate principles of that brilliant but unfounded doctrine, will engage our attention hereafter. The internal heat of the earth has been supposed

* Baxter.

supposed to have bestowed on its first, but not on Lucretius's productions, full type and magnitude. Then were produced giants, and dwarfs, and pigmies. But, those extraordinary species of beings only existed a certain portion of time. They fell into non-existence, because their nature required a greater degree of heat,* than was, even in Lucretius's time, felt in the Torrid Zone. This was the heat of a substance, vitreous, but fluid. Soberly and seriously discussed, (as I have, and often shall have occasion to remark) nothing is more clear than that we have scarcely more exact ideas of matter, than we have of spirit. And, hence argued the sceptics of old, whatever is proposed, is either sensible or intelligent; but, which ever it be, there is disagreement concerning it. Some hold that sensibles are only true; some that intelligibles are only true; others that some sensibles and some intelligibles are alone true. How shall these be judged? As a sensible, whether by a sensible or an intelligible? If a sensible, inasmuch as we disagree concerning sensibles, even that sensible will require another for its proof, which other, if it be sensible, will require another, and so in infinitum. But, if a sensible require to be determined by an intelligible,

* Buffon.

gible, inasmuch as intelligibles also are controverted, that as being intelligible will require adjudication and proof. Which way shall it be proved? If by an intelligible, they run as before into infinite. If by a sensible, inasmuch as an intelligible was assumed for proof of a sensible, and a sensible for a proof of an intelligible, the alternate common-place is brought about, or that what we should prove such a thing by, requires itself to be proved by that very thing.

These sceptics, who were of the ancient philosophers, perhaps, the most modest and the most perspicacious, neither affirming nor denying any thing, but, in truth, doubting of all; "Omnia in rebus humanis dubia, incerta, suspensa; magis omnia verisimilia, quam vera." These sceptics thought all our knowledge had the appearance of truth, rather than that it was truth itself. We deny any knowledge, said they, of the Divine Nature; because to know adequately, is to comprehend; to comprehend is to contain; and the thing contained must be less than that which contains it. To know inadequately, is not to know. From the uncertainty of our senses, our eyes represent things to be less at a distance than they really are. A straight stick in the water seems to be crooked The moon to be of an insignificant

insignificant dimension, and the sun to be greater at rising and setting than at noon. The shore, as the ship sails, seems to move and the ship to stand still. Square things appear round at a distance. An erect pillar to be less at the top. Neither do we know whether objects are really such as our eyes represent them to us; for the same thing which appears white to us, may appear yellow to him who is debilitated and indisposed; also, if a man rubs his eyes, the spherical objects which he beholds appear long or narrow, and so of the sense of hearing. The trumpet in a valley, makes the sound appear behind us, when it is before us. Nor is the smelling, taste, or touch, less subject to mistakes. But, the greatest fallacy is in the operation of our own inward sensations; for the fancy is sometimes persuaded that it hears and sees what it does not; and our reasoning is so weak, that in many proofs, scarce one demonstration is found, though this alone produces science.* From these sinister observations, they esteemed science to be conjecture, and knowledge to be but opinion.

I honestly confess, we in many instances believe where we cannot possibly demonstrate; and consequently, I can readily conceive why subtile

* Sext. Emp.

subtile reasoners should conceive our intellectual telescope for invisible beings to be little better than imagination. The soul is not *palpable*; yet, there is a soul—that is, a spiritual or a material intelligence. What are the faculties of this intelligence? If they do not immediately spring from mind, as distinct from matter—they must spring from matter as distinct from mind, for we have them. Now, with Locke, may I not be permitted to demand, whether the faculty of thought, admitting there be no soul, be confined to one particular substance of the body, or whether every different particle hath its different and appropriate fund of knowledge? Either the soul or the body must have intellectual perception. Which is the most difficult to believe? I do not deny, that the soul is powerfully affected by the senses. Matter acts with great energy on mind. Our frames open as many channels to its influence as we have pores. Our epidermis is a sieve, through which matter penetrates our systems; and thence circulates through every part. But in admitting the immaterial existence, we take a more satisfactory ground, than in admitting the material. It is not in darkness we seek light. The effluvia of a magnet though material, and powerful in their effects, are imperceptible with the microscope: never-

theless, we acknowledge their existence. May we not reasonably do the same, in regard to the soul? We feel it exists; at the same time I am free to acknowledge, it is impossible to take the elevation of immateriality; to divide what is indivisible, or to measure what has no extension. Spirituality excludes all ideas of combination.

The cause of the error, into which Lucretius fell, was the confounding the properties of the soul with the properties of the body. He saw, that a dead body, when the soul is separated from it, is incapable of its functions; that it cannot move, respire, or receive nourishment; or, what is more, that it is no longer capable of intelligence. And this, indeed, would hold good against immateriality, if the soul were naturally and essentially the result of body. But, if the body be rather conceived the vehicle of the soul, and that the soul continues in the body only so long as the body is ordained by nature to perform its functions; then the question will be entirely reversed. The constituent parts of animal bodies we daily see scattered before our eyes. But, is it worthy of our conception of Divine Wisdom to suppose, that the particles of gross matter, of which the body consists, should have been created from the first formation of

things, and that the soul, which animates, and so transcends this animal vehicle, should be only the formation of the moment, and be afterwards annihilated? Can body have had a previous existence to mind? Or is matter to be supposed eternal, and spirit to be merely incidental? Among the ancient philosophers, many were of opinion, that God made all things out of his own substance. But this was pompous trifling; and accordingly, Athenagoras contended, that if God and matter be the same thing under different appellations, then were it impiety to deny divine honours to trees, to minerals, and to stones; and still more strongly, that there could not be in this transitory state of things, either virtue or vice, pain or pleasure, unless God himself were impiously made to commit the one, or most disgracefully to suffer the other.

In like manner, the modern precursor of certain philosophers, Spinosa, says, "there is but one substance in the universe. All bodies, all intelligences, all thoughts, are all merely modifications of the one mighty whole. The effect is the same as the cause." Thus, it is not man that is to love God and keep his commandments: it is God that is to love himself and keep his own commandments. The child of death, is hence

made a portion of eternal life; the child of decay, a portion of the eternal existence.

"Nothing," says Zeno the Stoic, "that is void of mind and reason, can of itself generate that which is rational and animate; but, the earth generates animals and rational creatures: therefore, the earth is animate and rational: and thus the the whole world, and the heavens, are the substance of God. * But the fact is, it is contradictory, that any substance, whether material or immaterial, should be *generated*; and contradictory, that immaterial substance should vegetate; vegetation being performed by the accretion of parts. † All animal growth, or vegetation, is performed by a circulation of fluids, and not by a mere addition of parts, or agglutination to the outside of things, already complete. The origin, or rudiment, of a living creature, is one coeval system. All seeds are immediate and particular works; and hence they regularly preserve their kinds. The subject pre-exists, and the little system is complete, though not unfolded into all the perceptible members of an animal. But, when the body, folded up in this small volume, and its immaterial mover, were first united, is not a point so easily

* Diogenes Laertius. † Baxter.

easily to be determined. Many of the early Christian Fathers, and amongst others, Tertullian and Lactantius, held the soul to be *ex traduce* from father to son; and for these reasons: First, if every man has a new soul infused into him at his birth, by God, and not lineally transmitted to him from Adam and Eve, how can he be guilty of, or suffer for original sin? Secondly, if the soul be infused, nothing can be begotten, for the body cannot generate *per se*; and lastly, by such infusion, that man begets not perfect man, for perfect man consists both of body and of soul. But these arguments proceed on principles, with which the wisest of the ancients were unacquainted; and they, therefore, could only reason, as other philosophers have since ventured to do, that possibly the seminal atom, though existing from the first creation of matter the same individual system, may yet not be informed by its immaterial inhabitant, until it passes through various changes, to be at last deposited in the proper receptacle of the parent animal. Immaterial substance cannot be supposed to generate immaterial substance; any more than material substance can be supposed to generate material substance. Such generation would not differ from creation. And the opinion of the traduction of souls, must either sup-

pose, new immaterial substances generated, or that souls are material, or some certain modification of matter. *

"However marvellous, concealed, and complicated, our manner of action may appear," says Mirabaud, "if we examine it a little closely, we shall find, that all the operations, movements, and changes of the human machine, are regulated by the same invariable laws. At his origin, we do not perceive in man any signs of those qualities we call sentiment, intelligence, thought, or reason: these are the result of age and experience. They are acquired from the combination of those inert parts of matter, which, however apparently insensible and inanimated, at length come to form a complete living, acting, thinking, willing animal. Human beings are, like all others, susceptible of two sorts of motion. The one, is the movement of the body or any part of it; the other, is the internal movement, of which, in some instances, we are sensible; but in others we are ignorant, and can only infer them from their external effects. Life is nothing more, than an assemblage of movements; and movement is nothing but a property of matter." † Yet Hobbes himself, from

* Baxter. † Syst. de la Nat.

from whom this writer hath so largely borrowed, acknowledges that, "motus nihil generat præter motum." When we perceive a circle, or any other figure, do we perceive nothing but motion? When we observe certain colours, or when we survey any thing that is hard or soft, do we still see nothing but motion? or what is yet more extravagant, when we contemplate a body at rest, do we yet perceive nothing but motion? The truth is, we have the knowledge of many things, which have no affinity with motion. Motion can give us no idea of magnitude. Nor can motion give us any idea of elementary principles. Is it not too chimerical to say, that the bare putting together atoms which are dead and senseless, is the cause why the compound becomes endued with all the powers of the human soul; for matter is not one substance, but a heap of substances? Is it not like asserting, that the repetition of the negation of cause, multiplied so many times, becomes a cause? The contradiction, indeed, may be attempted to be lessened by saying, that infinite power puts the dead parts together, or moves them thus mechanically. But is this not miserably borrowing the authority of a word, to give currency to a fiction? Infinity of power does not exclude reason; and therefore cannot be a refuge for a contradiction.

That the junction of dead particles being itself a property, should be the subject of another property, is an absurdity the most glaring.* A compound of atoms, if it could form thought, is no more entitled to that prerogative, than a single atom. To what would this lead?

Matter, when at rest, we perceive, resists the being put into motion, and when in motion, it resists the being turned out of its direction: it cannot, therefore, perform that, the performance of which it resists. Must there not, therefore, be another cause, different from matter? Does not this very resistance prove the absolute certainty of another cause? An effect without a cause is not logical. Nor can any thing be, and not be, at the same time. No substance can be supposed capable of being at once the subject of two contrary forces or tendencies. Matter, in itself, is not active; it is re-active; it possesses a *vis inertiæ*, which is inseparable from it, and which is a property as essential to it as solidity. Fair reasoning, then, draws this conclusion, that the power which arbitrarily effects a change of rest or motion in the matter of a body, cannot be the matter of the body itself, which necessarily struggles against

* Locke.

against all changes of rest or motion. * But, here, when materialists are staggered, they say, the soul, it must be acknowledged, has been generated with the body; it has grown with the body; and at last, as certainly must decay with the body: at first it is feeble and weak—then it is powerful, and afterwards feeble and weak again. † "Hence, freed from prejudice," says Mirabaud, "if we look into our souls, or that principle within us that acts, we shall be convinced that it makes a constituent part of our bodies; and that by abstraction, it cannot be distinguished from it. The soul, we shall see, is forced to submit to the same changes as the body; it is subject to the like exterior influences; it partakes of the same pleasures and pains; it is healthy when the body is healthy; it is diseased when the body is diseased; it is affected by the different degrees of weight in the atmosphere; by the variety of seasons; by the aliments which enter the stomach; and in fine, it manifests visible signs of the numbness of age, of decrepitude, and of death."

Some part of this I have acknowledged—the rest is declamation. It is a mistake to say, the soul wears away, and decays with the body. Many

* Baxter. † Lucretius.

Many instances in the knowledge of every man will shew, that the decay is on the side of the body. Those, who have led sober and temperate lives, preserve a clearness of judgment, and a vigour of mind, to the last; though this cannot be said of those, who incessantly attack the springs of mechanical motion, and derange the activity of the soul, long before it leaves the body. It is remarkable, that the great philosophers of antiquity were men of long lives; and that many of them wrote, and taught, to an extreme old age. Of the body's being the vehicle of the soul, however, we have spoken above; here, therefore, we need only remark, that if we admit an eternal and infinite mind, and that this mind created matter, we have then a demonstration, that mind and reason do not belong to matter, for mind must have been before matter, and the creator of matter must have been before matter itself. * Hence, thinking and willing, whether in old or in young, cannot be qualities or affections of matter. Hobbes, on the borrowed grounds of the Materialists of antiquity, says, "the cause of sensation is an object pressing on the organ; which pressure is, by means of the nerves, conveyed to the brain, and so to the heart, where, by the resistance

* Bishop Sherlock.

resistance or counter-pressure of the heart outwards, it is made an image or phantom, which is sensation." And, consequently the acmé of his argument is, that as age impedes the counter-pressure which the heart can enforce, so dwindles away the mind in the formation of the images of intelligence. But this is not the case. The faculty of the mind, being spiritual, has merely a relative connection with the faculty of the body, which is material. Mind must have derived its energy from the bounty of the creative being. Perception and consciousness cannot have been indebted to a mass of atoms, divested of sense, of perception, and of consciousness. Intelligence is not an effect or composition of unintelligent figure or motion.

Locke endeavours to maintain, that our ideas are only arbitrary combinations, without connection with any thing in nature. This I cannot comprehend. But he is not always so obscure. He says, "Let us suppose God creates an extended solid substance, without superadding any thing to it, and so we may consider it at rest: to some parts of it he superadds motion, but it has still the essence of matter. Other parts of it he frames into plants, with all the excellencies of vegetation, life, and beauty, which are to be

be found in a rose or in a peach tree, above the essence of matter in general, but it is still but matter. To other parts he adds sense and spontaneous motion, and those other properties that are to be found in an elephant. Hitherto, it is not doubted, but the power of God may go. But, if we venture one step further, and say, that God may give to matter, thought, reason, and volition, as well as sense and spontaneous motion, there are those who are ready to limit the power of the Omnipotent Creator, and tell us, he cannot do it, because it destroys the essence, or changes the essential properties of matter. To effect a contradiction, is not the object of any power; nothing less limits Omnipotence: and such I must think it would be, to effect, that a substance which is solidly extended, and which resists all change of state, should, while remaining solidly extended, and while a dull, dead, earth, become life, sense, and spontaneous motion; for, that would be to say, it became living, sensible, and spontaneously moving earth, while it remained dull and dead earth."

It has been said, that whatever the properties of thought may be, they evidently depend upon the organization of the brain; and therefore, agreeably to all the received rules of philoso-

phy,

phy, they must be ascribed to it, and so that they cannot subsist without it. * Of this doubtful seat of intelligence, the brain, we have already spoken. But Priestley goes farther. He asserts his expectation of finding out, how the mind springs from organization; how the extreme link of causation is formed, before the ideas are produced. What a sublime reward, for the pains of intellectual contemplation! To be intimate to the act, to bring under positive observation, the thoughts streaming from the vibratiuncles! But by what inlet of perception will this glorious phænomenon be exhibited? Will the soul break in upon the optic nerve like the aurora of day? Or the finer chords of the brain, shall they utter forth a living song, and shall this song be mind? † Is this sound philosophy? The formation of the letters now before me, depend evidently on the organization of the quill, and its peculiar shape; the form, if printed, in which another would read them, would depend on that of the types adapted to receive the shape of the letters, and to impress it distinctly on paper. By all the rules of fair reasoning, must the writing and the printing be alone ascribed to the pen and to the types? The organization of the brain, supposing the brain to be,

* Priestley. † Material World.

be, what perhaps it is not, can be only the instrument, by which the soul conveys its volitions; for while it is connected with the body, we see none of its separate exertions. But it cannot follow, that there are none, till we can explain the sensations of consciousness, from the organization of matter only. It is clear deduction, then, if we perceive that matter, in any way organized, is to our conception incapable of those functions which we see in living man, to suppose that a principle is superadded to occasion the difference. *

This doctrine of the materiality of the soul, is not, as we have seen, a new one; and of course, it has been combated. A whimsical recipe was once, however, drawn out for the material formation of a soul, which it may not be wholly uninstructive to repeat. Take quantum sufficient of bread, beef, or other suitable aliment: put it into the stomach of a human machine. Let the stomach work till it be converted into a laudable chyle. Let that chyle be thoroughly mixed with the blood: let that blood be warmed to a due heat; then take the fumes arising from the blood so tempered; let them be distilled through the alembicks of the brain; defecated and refined: and

* Critical Review, 1787.

and if one operation should not be sufficient, let them be double distilled, and double refined. Then shally ou see, these invisible atoms become, all at once, reflection, memory, judgment, wit, will, loco-motive power, and every other faculty of the mind. But, if you pursue a counter-operation to that of distilling and refining, you will have the contrary effect, and you will condense any of your light, airy, volatile, refined, and speculative spirits, into as gross, unrefined, stupid, unthinking matter, as you would wish to lay your hands upon. A piece of coal cannot think; yet when it is refined into smoke and flame, does it not evidently become more active, volatile, and subtile, and consequently approach nearer to thought, if not actually to think? Wine is a thoughtless creature, but yet it is called a spirit. It drives the machine, when taken inwardly, around like a mill, and grinds matter into thought, with an amazing celerity. If a piece of bread can be transubstantiated into an intelligent spirit, it is but going one consistent step further, to transubstantiate it into an intelligent power, superior to all human power. We cannot, with certainty, fix the precise limits where the animal or the vegetable life, or where even the simple organization begins. But, should things essentially different, be on this account

confounded?

confounded? Because colours will gradually melt into one annother, are we therefore to say, there is no difference between black and white?

When a body is put in motion, we frequently see the principle of this motion to be foreign to the body: but with respect to the soul, we cannot discern any external principle of its thoughts and will. We, indeed, see the occasion in objects that strike our senses; but, it never can be supposed, that a corporeal object is the principle of thought, or that it produces it. The principle, then, of thought, is in the soul itself, as mankind have currently believed it to be. Should I advance, as a first truth, that my soul produces motion in my body; and Malbranche, on the other hand advance, that a mind cannot act upon a body; in this situation we prove nothing to each other. But, I have on my side the sentiments suggested by nature to the generality of mankind in all ages; and on his side, he has a particular reflection; that is, he does not see any relation between a mind and a body; or in the idea of his soul, he does not find the faculty or virtue of moving a body. A reflection, from which this inference alone can be drawn, that a thing is not, because he does not see it, and can have no idea of it. To deny, there-

therefore, upon any good foundation, that the soul is capable of moving a body, we should be fully convinced, that we have a clear and perfect idea of the whole nature of the soul, and that we know its secret and real essence; but, this is not the case, as all the world knows. If it be said, I do not comprehend what is the principle of acting in creatures, I readily acquiesce. I know, however, that there is in my soul a principle that puts my body in motion, and if I do not understand the source or spring of this principle, I do not presume to explain it. *

The nature of the soul is so involved in incomprehensibility, that the most discerning philosophers have not been able even to conjecture what it is. But, can the fabricators, who, under different denominations, have admitted of a chaos of corpuscles, and of an universal matter, of which they pretend all things have, or all things might have been made, by the bare impulse of motion; can they conceive how an organized body could have been formed, much less how it could have been endowed with intellect? Toiling, at the expence of life and fortune, in their gorgeous laboratories, they cannot, though with the experience of some thousands of years before them, make a sorry bit of gold; and yet

* Buffier.

these men can boldly set limits to Omnipotency, and pride themselves in the hardy idea of understanding the component parts of animal existence. But, vanity out of the question: man may plunge into error; for it is not given him to know, how either spirit acts upon spirit, or spirit upon matter. Suppositions and conjectures may unpresumingly be framed; yet the result is to every one nearly the same. That eludes the comprehension, which the fruitless struggles of the imagination would grasp at, but which the ruler of the world has not submitted to its cognizance. And hence even constant contradictions in the same inquirers; for Priestley himself says, "If by the word immaterial, we mean simply to express a substance, which has properties and powers, essentially different from those of matter, it is clear I can have no objection to that expression. I believe it to be in effect, what all the world believes it." Is not this the admission then of a something, though not of an immaterial something?

This mortal existence of ours is so perfectly a rapid journey, and the objects that present themselves so flee before us as the mists of a summer's day, that whirled in the undissipating cloud, we have scarcely time to be satisfied of the imperfection of our vision, much less to be

able to comprehend the demonstration of a metaphysical truth. Round almighty causes the God of Nature has drawn an impenetrable veil. Man, in his career, can only glance at them. Thus, it is with respect to that astonishing faculty we possess, which at the same moment distinguishes the past, the present, and the future, which neither distance, time, nor place, can affect. In the midst of the darkest night, we can, in imagination, contemplate the noon-day splendour: in the barren cavern of the ruthless rock, we can, in imagination, stray through groves, and wander through fields laden with abundance. This *self* that thus reasons and reflects, which, though invisible, sees every thing; which, though present in all parts, yet occupies no space: this self, am I not to conclude it independent of body? Where it resides, as I have already said, I am unacquainted; whether in my head, my hand, my foot, or all over me, as a vapour pervading all. This, however, I can determine, that it is the same self, which feels every thing that arrives at the different parts of my frame, as well as every thing that comes within the grasp of my intellect. I am fully sensible, it compares and judges; yet I know it is not my eye, my ear, my tongue, or any one particular organ of my body. My eye cannot judge of

sounds or odours, my ear cannot judge of colours, nor my tongue of harmony and sound; moreover, I feel a total ignorance by which of the senses it is I am made acquainted with the salutariness of moral rectitude. Where is it the honest man finds that good faith, for which he is so much admired? Where is it placed? It is not a chimæra. In what part of the frame does it take up its residence? or, to speak after the doctrine of the Materialists, of what corporeal natures are candour and ingenuousness? Are they round, or are they angular? Bodies must be of some shape. But, let us, with an anatomist, take the bewildering journey of the whole animal system; let us wander through nerves, and wade through fluids: all will be to no purpose. In the complicated labyrinth of this constant circulation, we shall not be able to pick up one stray thought, not even one solitary idea. In short, it would be as reasonable to believe the *Coliseo* of Rome built of ideas, and that the levers used in its construction were mental reflections, as to insist upon the corporeality of thought, or the material consistency of intelligence.

But, the modern Materialists denial of what has been by the wisest men looked upon as immaterial,

material, and their substituting in its place an unknown substance of material nature, distinct from the properties of solidity and extension, but which may be the subject of them, and also the subject of thought, is a position savouring too much of the pretensions of the scholastic *ipse dixit*. How can such philosophy explain this unknown substance? Or is it in its power to give it a more colourable bearing than that which is given to the spiritual substance, as specifically contradistinguished from matter? Pyrrho, with others of the Sceptics, affirmed, that an incorporeal substance could not produce body; and the reason he gave was, because no incorporeal thing produces substance. And again, he said, that body does not produce any thing incorporeal, because the thing produced must be made out of a passive subject, or pre-existing material.* But Priestley's opinion is not the opinion of the Sceptic. He does not deny a first cause, nor does he deny a creation, by the agency of Providence. That a material unthinking substance is not able to produce an immaterial thinking one is clearly to be admitted: nothing can be made from nothing. But, that an infinitely perfect and intelligent being cannot create a material substance, is what

* Diogenes Laertius.

every day's experience proves to us to be false; for is it seriously to be argued, that God is as unable to create a system of atoms, as dead matter is to be supposed to perform the like effect?

If we deny the Almighty power, to what are we reduced? Exclusive of an intelligent cause, mechanism, or chance, are those alone which we can advert to. But, it is scarcely to be supposed, that any man understanding the import of these two words, can assert that either of them has been the cause of the immaterial faculties of the soul. Of mechanism, or motion, we have already seen the mental incapacity. But, is chance a real efficient cause, a positive agent, subsisting of itself? This is a miserable substitute. Chance is no cause or agent, but is simply a creature of man's intellect. Chance is but a notion, and such a thing as schoolmen might call an extrinsical denomination; and signifies no more, than that in human apprehension, the physical causes of an effect did not intend the production of what they nevertheless did produce.* And is it to this blind and unintelligent operation that we are to turn ourselves, instead of adverting to the sublime and animating belief of a perfect and universally pervading

* Boyle.

vading intelligence, lodged in the essence of God himself, and in certain modifications diffused through the various ranks and beings of existence? But, this is still more strongly noticed by Cicero: "What can be more weak, arrogant, or unbecoming," says this elegant academician, "than for man to think he possesses a mind and understanding himself, but yet, in all the universe beside, that there is neither mind nor understanding? Or that those things, which, with the utmost stretch of his reason, he can scarcely comprehend, should yet be moved and managed without either reason or intelligence?"

One difficulty, indeed, has more forcibly, perhaps, than any other, perplexed philosophers, in their inquiries into the qualities of the soul. They have not been able to conceive when or how immaterial substance could have been joined to the substance of matter. But this difficulty, though not to be removed, is yet in some degree to be relieved, by considering our ignorance in regard to more familiar objects. For instance, can we in any manner satisfy ourselves how the animal body previously exists, and afterwards attains so wonderful a bulk, in comparison with its prior imperceptible magnitude? Des Cartes, indeed, whose fervent imagination saw difficulty in no-

thing, is said to have fancied, that the soul was a being independent of the body; that, as a residence, it would in general occupy the body, but, that its flights from it were frequent, and often for a length of time. Sometimes his own soul, he conceived, would wander through all France in a few seconds, and afterwards return to its cage. Again, that it would be absent for hours together; and on its return home would find its material tenement fixed unalterably in the same position; perhaps in that very position of taking a pinch of snuff, which was usually supposed the prelude to his abstractions. At this sort of reverie we undoubtedly may smile. But, Locke says, the mind fixes with so much earnestness on the contemplation of some objects, that it turns their ideas on all sides, remarks their relations and circumstances, and views every part so nicely, and with such intenseness, that it shuts out all other thoughts, and takes no notice of the ordinary impressions made then on the senses, which at another season would produce very sensible perceptions.

It is a phænomenon of the human mind, and one altogether inconsistent with materiality, that a man absorbed in ideal contemplations, can sit in a large company, and yet neither hear nor see

what

what is doing round him. This indisputably proves the power of forming abstract ideas, and that this power of the imagination is in no respect impressed by matter. In an instant the mind unites itself to the most distant or the most elevated objects, and nothing can prevent this union. Earths, stones, metals, worlds, all may be placed before it; it yet bursts through them all, and neither suffers injury nor diminution. But, the body is incapable of uniting with any object; every thing wounds it that makes too near an approach. Is will then nothing more than a corporeal motion? and is contemplation only a simple contact? How could this contact be affected with remote objects or abstract subjects? Or how could this motion be instantaneously accomplished? Without space and time the idea of motion is inconceivable. If the union of the mind with its object be a contact, it must be a contact, or rather an intimate penetration at a distance, qualities which are the reverse of those of matter, and which of course can only belong to an immaterial being.* But, to go still further, if the mind be material, it must, like the electrical fluid, or like the rays of the sun, have a *momentum*; and to ascertain its perceptivity, that momentum

* Buffon.

momentum must be caused by a continuity of its particles, either as its thought is turned, for instance, from the Equator to the Pole, or from the earth to the star the farthest from it in the concave of the heavens. Common minds are amazed at the celerity with which the electric matter travels; more mathematical ones wonder at the rapidity of the matter of the sun. But, what is the matter of electricity, or the matter of the sun, to the matter of the mind? In its progress through the regions of space, light is computed to get to the earth in about seven minutes, and the time is almost inconceivable when compared with the distance. But, the momentum of the mind (for the advanced particle must impinge on the object of contemplation, that it may be reflected so as to form thought) regardless of every distance, strikes in a second upon the whole circumference of the universe: even while the pen can trace a word, the whole planetary system is to be brought within my intellectual observation. If this be the case, and no otherwise can the momentum of a material mind be conceived, the indefinite link of one sort of material particles, must be at the pleasure and entire disposal of another indefinite link of another sort of material particles, or those which are

the

the first causes of this material volition. But, is this philosophical or satisfactory? Or is it to be credited in preference to the operation of a spiritual intellect, immediately proceeding from the hand of the Divinity himself?

LET-

LETTER LIII.

THE spirit, or rather the tenacity of system, I am aware, should be avoided. Knowledge is clouded by prejudice. Truth should not be sacrificed to brilliancy of thought, nor good sense to elegancy of expression There is nothing, which may not be distorted; nothing so grave and serious, but ingenuity may make extravagant. An odd association of incoherent ideas, inevitably creates ridicule. An odd association of unconnected philosophical principles, as effectually creates inconsistency. One man says, physical knowledge is inexplicable without reference to metaphysical data, that the sensible material properties cannot subsist but by the various powers of attraction and repulsion, matter being liable to be so dissipated, that not the smallest particle would remain without an active cohesion; and that without repulsion, no communication of motion could take place. Another says, metaphysical data cannot enable you to command the inward parts of your own body, much less

of any other body. The lungs, the heart, the stomach, the brain itself, do not wait for your directions. They have an action of their own, independent, and sometimes contrary to all your desires. Take, however, a part of the daily nourishment of a man, the herbs, the vegetables, the bread, and the meats: take mortars, pestles, water, wine, fire, salt, vitriol, spirit of nitre, and as many dissolvents and agents as you please; add to these, strainers and sieves, in short, all the necessary tools for grinding, dissolving, and filtrating. Notwithstanding all this apparatus, you will never be able to give us one single drop of chyle, and still less be able to shew us the smallest globule of blood. But, is this an imperfection in your nature? No. It is, on the contrary, an honourable exemption. It is an ignorance and an incapacity, which, far from arguing any deficiency, facilitates the enjoyment of your privileges. Wisdom would still advance a step farther, and say, it is that which should convince you however wayward, that God is kindly leading you one way, while a perverse philosophy would draw you another.

Innumerable are the appearances to which human reason cannot be reconciled; for they in fact contain mysteries which are unfathomable.

Would

Would it not be using weapons, therefore, against ourselves, to pretend to prove by reason a thing, which we acknowledge reason cannot reach? The laws of physical nature must either arise from the direct operation of a Supreme Being, or from the unalienable properties of matter. Whichever be maintained, we do no more than run the risk of common right and wrong: but, by admitting the phænomena of the world to be produced by the powers and properties of matter; and at the same time to believe, that every thing is performed and occasioned by the immediate agency of the Deity, is to entangle ourselves in inextricable error. To pursue this, however, no farther—Of the indisputable qualities of the mental parts of man, there is a difference between consciousness and perception; and this difference seems to be, that perception is generally understood of external objects; but that consciousness is the recognition of the impressions the mind receives from external objects, and of the internal operations of the mind itself, whereby it becomes demonstratively assured of its own existence, in contradistinction to every other being.* And who was ever able to discover that the soul could, in any one moment, be in a state of unconsciousness? The soul, it is true, grows weary, just

* Material. Exam.

just as the body does. When fatigued with too intense or too long an application, it loses in some degree the faculty of applying itself to any subject. Should we attempt to force it, every exertion becomes feeble, and we approach towards a state of insensibility. And thus, that memory which collected ideas, that understanding which arranged them, and that judgment which determined the propriety of their union are all vanished. And hence it is we find that in the vigour of our lives these intellectual powers are strong, but as we decline they become feeble. Or, as Fontenelle used to say on the decay of his memory, "I am on the point of removing into another country, and my memory is sent off before me with the heavy baggage." But, even in the spring-day of our existence, that which is obvious is not always known, and what is known is not always present. Sudden fits of inadvertency interrupt vigilance; slight avocations seduce attention; and sudden eclipses of the mind darken learning. So that a man shall often, in vain, search his memory at the moment of need, for that which he yesterday knew with intuitive readiness, and which will come uncalled into his thoughts to-morrow.

The

The mind, it is thus evident, not only becomes fatigued like the body, but they both become fatigued at the same time. The fatigue of one is always accompanied by the fatigue of the other. If the body be fatigued to excess, the mind cannot give attention to any object: its perceptions are weak, it wills nothing strongly, it seems even not to retain the power of determining itself. Should the mind be fatigued to excess, external objects produce only weak impressions on the senses, and these impressions only weak sensations on the soul: motion is painful, and all the organs are in a stupor. In our recovery from a long and severe fever which has consumed the principle of strength, the soul is as weak as the body, the sensations have no vivacity, sentiment is dull, desire is languid, and we receive no pleasure from the most agreeable objects; recollection is likewise decayed, and we scarcely remember an action done the moment before. The more this disorder of the body prevails, the weaker is the soul. As the organs regain their force, conception gradually returns, but is not in its vigour till the body be perfectly recovered. Yet, although the soul be in this manner influenced by physical laws, its power over the body is infinite. By a simple act of the volition,

volition, it moves the limbs either separately or together. In passions, it affects the body a thousand different ways, agitating our organs, and sometimes even destroying their œconomy. While under the influence of joy, the countenance wears a gracious smile, the complexion is lively, the eyes shine with redoubled lustre, respiration is more free, the body receives new vigour, sensibility is increased, and we feel a voluptuous motion about the heart. Excess of pleasure, however, affects us with languor, stupifies the senses, disorders the motion of our organs, and nearly deprives us of all sentiment; for the human frame faints through excess of joy, as it does through extreme of pain. How different the effects of joy from those of sadness! Is the soul overwhelmed with sadness, the countenance becomes pallid, the eyes lose their vivacity, the muscles of the face relax; we feel a tension in the region of the heart, a weight on the diaphragm; the circulation is impeded, and becomes languid; our strength fails us, and all the body is affected. In fear, the limbs are actuated by a violent tremor, the blood congeals in the vessels, our strength fails us, the use of the senses is suspended, the voice dies away on the lips, languor arrests our motions, our organs are in a stupor, and all their œconomy is

disordered. Should it be extreme, it extinguishes the lamp of life. It has been even known—to anticipate the executioner and the enemy. *

If, when the body is extremely agitated, the soul enjoys no repose; so neither does the body enjoy any, when the soul is strongly affected. When night has wrapped all things in her sable mantle, man is not always sure of rest. While other creatures enjoy the blessings of repose, or seek the gratification of present wants, man is the only being to whom care denies sleep; and want of sleep exhausts the last remains of bodily strength. When the soul is affected by any passion, it instantly affects the body; always in the same manner in every individual; and ever differently, according to the nature of the emotion. Although the soul affects the whole body, yet it does not affect all its organs equally. When the emotions produced on the *plexus nervosi*, (agreeably to the generally received system) have a certain degree of force, they communicate to the diaphragm, to which this plexus is united, a transient convulsive motion, which produces bursts of laughter: for laughter, which is a sound suddenly interrupted, and frequently resumed, is always produced by a tremor of the dia-

* 'Essay on Man.

diaphragm. This motion of the diaphragm affects the lungs, which it precipitately elevates and depresses: every time the lungs are depressed, the air is expelled through the mouth with a certain noise; and this is that sound of the voice, which is often repeated in laughter. That sudden starting, likewise, and constriction, which we experience when we begin to think of some evil affecting us, is produced by the contraction of the diaphragm, which participates of the nature of a spasm affecting the plexus nervosi. This constriction of the diaphragm raises the lungs, and occasions that strong expiration called a sigh. When new impulses of sorrow succeed immediately one after the other, the air rushes suddenly, and by intervals, into the lungs, produces frequent expirations, and every expiration occasions a sound stronger than sighing: this sound frequently repeated, is what is commonly termed sobbing. When the spasms begin gradually to diminish, the air is not expelled so readily from the lungs; expiration is repeated at great intervals, and produces a louder sound, called groaning; for a groan is only a continued sob. —Finally, when relaxation succeeds to these spasms, the lymph distils from the lachrymal

glands, situated in the orbit above the lesser canthus of the eye, and this lymph is called tears.*

We commonly regard tears as a sign of sadness; but without reason. They are the effects of every passion which contracts our fibres: fear, anger, and even joy excites them, as well as sadness and pity. They are never expressed until the glands begin to relax after contraction; hence the reason why moderate grief causes tears to flow, while excessive grief suspends them. By a forcible impulsion, or influx of the nervous fluid, an aptitude to the most powerful oscillation is produced in the vascular system: the blood is thereby impelled to the extremities of the cutaneous capillaries, and into the organs of motion, which renders it susceptible of vigorous action: hence the impetuous motions of rage, and the prodigious force of phrenetics. Such is the manner in which nature sometimes renders weakness equal to strength, by means of despair. This influx of the fluid of the nerves into the fibres, produces in the *plexus nervosi*, especially in the ramifications wound round the trunks of the veins, a small degree of rigidity; these vessels are thereby somewhat obstructed, and the return of the blood to the heart is attended with difficulty;

* Essay on Man.

culty; whilst it is carried from the center to the circumference, with its usual freedom: the vessels are thereby greatly distended at the surface of the body: whence springs that fiery redness of countenance, that fire of the countenance, which ever accompanies rage. But, for what reason does the soul impel the nervous fluid into the muscular fibres, rather than into their fibrillæ? Why into one organ or muscle, more than into another? Why, in shame, does the head incline forward; in sadness, and in languor, on either side? By what means does the soul, in the different passions, impel the nervous fluid into any particular nerve, any particular muscle, or any particular organ, exclusively, whilst every part of the body partakes of nerves which are common to all, whose fibres are ever exposed to the influence of this fluid, which incessantly pervades them? Why is insanity a loss of reason, sometimes without fever; why is that inflammation of the brain called phrenitis, always accompanied with an acute fever; why is it that symptomatic delirium, arising from fever or other causes, neither insanity nor phrenitis, but, as a mere symptom, only requires an accurate discovery of real causes, to restore the afflicted to the free and judicious use of his mental faculties? All of these are incomprehensible mysteries.

It has been observed, that man may lose the power of meditation, yet retain that of reflection; that he may lose imagination, sagacity, and penetration, yet retain good sense; lastly, that he may lose judgment, and yet retain instinct. Le Cat, and others, to account for this, have erroneously supposed each faculty of the soul to have some particular organ for its seat; and that this organ being vitiated, the faculty resident therein becomes depraved likewise But, this subject we have already discussed; and therefore it is only to be remarked, that such phænomena cannot establish the dependence of the rational nature of the soul on matter, for its perfection; nor can they in any other way be supposed of powerful consideration in this question, than by serving to disturb the intellectual principle, and thereby momentarily to cloud or derange the energy of its faculties. During the rapid motion of the blood in a fever, the natural powers of perception are distorted. The representations of things are disturbed; like images shattered by a sudden ruffling of the waters. Yet, who can say, he ever found himself in a state of unconsciousness; or when there was no one idea existing in his mind? "Sound sleep," says Locke, "closes the scene, and puts an end to all appearances." But this is not a positive cessation

cessation of intellect. It is experience only of having no recollection of consciousness at that moment, but such experience does not infer that we have no consciousness at that moment. No man at night would infer that he was not in a state of consciousness and thinking at a certain hour of the day, because at the present moment he has no memory of what was in his thoughts at that hour: and it is no better argument, that a man was not conscious at such a minute in his sleep, because next morning he had no memory of what ideas he had while he was asleep.

This is a subject of subtile distinction. The soul appears never to be totally inactive. Few ever awake but find themselves coming out of a dream. They who think they do not dream, think so because they forget their dreams. And though the point were not to be accurately determined, probability inclines most to the incessant action and perception of the soul. *Volucrique simillima somno*, is a lively description of the fleeting visions of sleep. While we are awake, we are apparently under the necessity of thinking. If then we were always awake, we should be always under that necessity. But, of the consciousness and activity of the soul, we are even in

waking moments constantly losing the impressions. In sleep, however, common experience assures us, that most of the representations which are offered to the mind, are not only not produced by it, since it has no consciousness of any act of the will to introduce them, but that they are involuntarily intruded upon it. It hears, sees, and feels objects at that time, not as it would itself, but, such as they are made to appear to it, and is just as passive in receiving these impressions, as it would be in receiving the like impressions from real external objects, by means of the senses when broad awake. How feelingly alive are we, in our sleep, to dreadful heights, precipices, or other dangerous situations, where we are in the hazard of falling, or are actually tumbling down! How feelingly alive are we to every species of delight and gratification! Sometimes we think we are flying aloft in the air, sometimes we are struck with feebleness, so that we cannot escape from an enemy who is in pursuit of us. In a word, in our sleep, we are dejected, elevated, and affected in every possible way.*

An argument, that this may be the result of the mechanical disposition of the body, is brought

* Baxter.

brought from various distempers to which the body is liable, and which exhibit the mind delirious and mad; but which the power of medicine can cure, as it can the derangement of the body. But, no man can seriously persuade himself, I should think, that the simple indisposition of the brain, or any other part of the body, that is, a mere disarrangement of material parts, can be a sufficient cause why a scene of vision is obtruded on the soul, where there is life and reason. Can a defect, the utter negation of a cause, perform things of so high and so consistent a nature? Order, and want of order, cannot be the same. The sleep of the rational man, cannot be a state similar to the restlessness of the delirious man. But, as we have already seen, reason is not the result of a mechanical disposition of matter; nor can the intellectual principle, though in vision, be material. Delirium itself is a complex thing; it implies reason, and the disorder of that reason. As we are accurately sensible, sometimes, in dreams, how are we to suppose that the soul should be percipient of impressions, which at the time are not; or not percipient of those, which are? Another argument, brought by Lucretius, is drunkenness. "The eyes then roll," says he, "the tongue faulters, the legs stagger, and the

soul

soul itself is inebriated." But, this requires no particular answer. Drunkenness is nothing but a disease. Madness is for a length of time; the delirium of drunkenness is for the moment.

It has been well said, that the bodies are ours, but the souls are *us*; and that he seems to revolt against himself, who raises the body above its rank. * The simplest definition that can be given of dreaming is, that it is the apparent means of exercising our sensible powers, while the organs are deprived of any external impressions, and of their usual faculty of acting. This is entirely however, perhaps, a subject of conjecture. But it appears plausible, that it is the exercise of our mental faculties, while those that are merely animal are incapable of any action; that involuntary power of thinking, which every man enjoys when awake, and which makes his reveries like the dreams of a man asleep. Lucretius says, "We must investigate the nature of the soul, and what it is which occasions those frightful visions to us, either while broad awake, when sick, or while buried in sleep; so that we think we hear and see those before us, whose bodies are laid in the earth." Hobbes, likewise, is forced to confess, what

* Baxter.

what, by the way, he is not very correct in, that from the ignorance how to distinguish dreams, and other strong fancies, from vision and sense, arose the greatest part of the religion of the Gentiles, who worshipped satyrs, fawns, nymphs, and the like * The origin of dreams, indeed, was always given by the ancients to the Divinity. Achilles is made to say, dreams come from Jupiter; and Agamemnon tells the chiefs convened in council, that "the divine dream came down to him through the ambrosial night." Among the eastern philosophers, the interpreting of dreams was accounted a part of wisdom and philosophy, and was accordingly much cultivated.

Aristotle, when he gives the definition of a dream, is explicit, in making it only extend to what the soul is not active in. He makes the dream only the φαντασμα, the appearance, vision, or thing represented, arising from the motions excited in the sensory or brain. He says, it would be absurd to call any thing a vision that that the soul does itself; as for example, to say I dreamed that I thought, is improper, since I really did think; nor would it be less improper to

* Leviathan.

to say, I dreamed that I saw, or that I heard; for I had really these perceptions, though their objects did not exist externally. Of the incongruities of dreams, arising from a too sluggish, or a too rapid circulation of the blood, he says, "As any liquor, if it be shaken, sometimes represents no image at all, and sometimes represents the image distorted, and different from what it should be; but, if the liquor be undisturbed, the image appears plain, and conspicuous; so in sleep, φαν]ασματα, and impressions, sometimes disappear altogether, when the aforesaid notions are strong; and sometimes the visions mishaped and monstrous, and the appearances but slender and weakly impressed; as happens to melancholic and feverish persons, or to those who are drunk." All these, therefore, are spontaneous and involuntary; and can any thing which is spontaneous and intellectual, be explained materially and mechanically? We dream, a man pursues us with a drawn sword, and threatens us with death. Is not here design, life, action, articulate words, importing connected ideas, and those ideas excited in the soul, and all involuntary and spontaneous? The mirror does not represent images when the objects are not present. Nor are we to accede to Epicurus's dance of atoms,

atoms, and suppose inert particles of matter to fall by chance into the formation of something to imitate action, life, and even reason.

There is one circumstance in dreaming, which is perhaps the most wonderful of all. In our sleep, persons and objects are frequently presented to us, with the novelty of which we are in no manner surprised, because we seem to know them. They are represented as known and familiar objects, and we allow them to be such, being acquainted with them at first sight; though we know not how, nor when such familiarity was contracted: for on awaking, we wonder how we thought we knew them, or entered so easily into their designs and business. We frequently dream we come into a company, where we seem to know, what we came for, and what is every one's part of the business in hand: or we are all on a suddden engaged in circumstances, and a course of action, which appears to us to be the consequence of former action, which we readily own we have been concerned in. A man imagines he is in danger or trouble, because he did such things formerly, of which he seems to know himself guilty: he is stung with grief and remorse for crimes he allows he perpetrated some years before,

fore, or he is praised for great and virtuous actions, of the merit of which he seems secretly conscious. In a word, there is this incomprehensible difference between what we see while awake, and what we see while asleep; that if we see any thing new, while awake, we know that it is new to us, and find that difficulty and uneasiness in us, which results from ignorance; but, on the contrary, though we see a thing for the first time only in sleep, it is so far from being new to us, that it is intimate and familiar. This phænomenon is striking. It shews the soul capable of a more perfect and ready knowledge of things, while the body is wrapped in rest, than while the senses are all alive, and seem searching for impressions. Farther, it would lead to a conclusion, perhaps, relative to an after state, and to the enlargement of what we shall afterwards have occasion to consider, our immortal faculties.

But, no philosophical or satisfactory explanation can be given of dreaming. Some men puzzle themselves about their efficient, and others about their final causes. Some labour to prove that dreams have been, and may be of use, not only

only in moral and political, but even in the way of physical admonition; and that persons who attend to them, may make important discoveries relative to health, fortune, and moral improvement. This, however, though it has antiquity to support it, can only excite ridicule, as bearing evident marks of dotage or imposture; and is scarcely less absurd than the doctrine which would demonstrate, that the beautiful system of material nature, the heavens and the earth, the sun, moon, and stars, all the wonders in the vegetable and animal œconomy, their usefulness to mankind, and the kindness of God in bestowing them, are nothing but a dream, a fleeting vision of the mind.

Lord Bacon observes, that since abstract ideas have been introduced, and their dignity exalted with so much confidence and authority, the dreaming part of mankind hath in a manner prevailed over the waking. This is, however, too severe. At the same time, I cannot, in my own mind, refrain from classing certain writers, with that Priest, who, in a discourse upon the human soul, having found in a Greek author ὁ νους εξιν ἀυλος, *mens humana immaterialis est*;

est; and finding in his dictionary, that αὐλὸς was a flute or pipe, very piously introduced fifteen arguments into a thesis, to prove that the human soul was nothing more nor less than a whistle.

LET-

LETTER LIV.

IN disquisitions purely speculative, we are free to differ from one another in opinion. Truth is the point at which we all endeavour to arrive, and therefore, liberty is to be claimed and granted universally. Nor should any man be so chained down to an opinion, as to be precluded from a power even of revocation, whenever better information shall be given him. That philosophy, at once the parent and the progeny of truth, should have undergone perpetual changes, would seem extraordinary and unnatural, were it not evinced by that fate which hath universally attended every system that has hitherto appeared. The doctrines of Aristotle and his followers, were for ages received and cherished, as irrefragable. Galileo, Torricelli, and Descartes arose and laid a new system, in which they were followed by Malbranche and others. Hobbes extended the regions of the new philosophy. Locke, who followed, and

was greatly indebted to Hobbes, still carried it farther; till at length Aristotle and his disciples were fairly driven from the field. Perhaps the diversity of opinion which has taken place among mankind, may be in some measure accounted for, by remarking, that with respect to knowledge, three different dispositions are found in men. The first, a torpor, or animal stupefaction, to know nothing that is around us. The second, an inclination of enthusiastic arrogance, to understand every thing. And the last, an ambition, warranted in every case, of investigating, and approving as much as possible, whatever lies within our power, or within the reach of our comprehension. *

The science of man has been often and diffusively treated, by ancients as well as moderns. Some have examined it corporeally, others mentally; but, few conjunctively. Many have been metaphysicians, who have not been anatomists; and anatomists, who have not been metaphysicians: and thus they have been accustomed to consider the phænomena, independent of their mutual connection: they have not perceived the causes of the reciprocal influence of the soul on the body, and of the body on

* Buffier.

on the soul.* Galen and Hippocrates observed some phænomena of this reciprocal influence; but, they believed the soul to be material. Many observations since their days have been made on the like principle; but, Descartes was the first who undertook the subject systematically. Yet, even Descartes, as his anatomical knowledge was imperfect, and his metaphysical notions more brilliant than solid, fell far short of the expectation which his inventive genius had raised. He first confounded the impressions of external objects on the senses with the ideas of the mind, and then made the different affections of the soul to consist in modifications of the animal spirits: he assigned different parts of the head for the seat of the different mental faculties, and allotted to every idea a particular tube of the brain. From the action of these spirits on the different organs, he accounted for thought, judgment, good-sense, imagination, memory, and remembrance. To Descartes succeeded La Metrie. Led away by appearances, La Metrie searched no farther than the surface. Atheists applauded his L'homme Physique, wherein, without attempting to account for the reciprocal influence of the soul on the body, he reduced every thing to the latter of these substances, and

* Essay on Man.

believed a thinking and free being, susceptible of virtue and remorse, to be wholly material. Secondat de Montesquieu, a man in whose mind delicacy, sagacity, and depth of thought were happily blended, afterwards came, and in his Spirit of Laws openly despised the unintelligible jargon of psycologists, and confined the study of man within the limits of experience. Helvetius, though ignorant of them himself, wrote with a professed design to demonstrate the usefulness of skill in anatomy, of proficiency in physics, and of knowledge in the reciprocal influence of the soul on the body, in disquisitions of this nature. He attempted to reduce every phænomenon in man, to moral causes. Hence his work is a series of sophisms, elaborately adorned with a pompous display of erudition. Haller, a celebrated physiologist, has likewise treated this subject; but, not with his usual success. He confounds the faculties of the mind with the properties of matter; after assigning the cerebrum as the seat of the soul, and as the sole organ of its operations, he labours to deduce from the different degrees of consistence in the viscus, and from the diversity in the circulation of the blood in its fibres, the reason of the phænomena, relative to the influence of the physical on the moral faculties of man. Le Cat engaged in

this

this enterprize also. He was a skilful anatomist: he applied himself closely to the study of nature: and would have penetrated far into its arcana, had he not been rather too fondly addicted to systems. In his works, are good observations, many scattered rays of light, and much fair argument. There were others, also, who engaged in the same pursuit: but, except the small number I have thus recapitulated, none are peculiarly entitled to notice. Pascal, Racine, Voltaire, Hume, Mirabaud, &c. &c. at length made their appearance, confounded all systems, and treated all, indiscriminately, as ridiculous: they even looked upon the design of searching into nature as presumptuous: and entrenched behind the fortress of genius, they contemned the modest enquiries of less arrogant philosophers, and thundered upon the unlearned, volleys of wit instead of argument.

Genius, and not the want of it, adulterates philosophy, and fills it with error and false theory. A creative imagination disdains the mean offices of digging for a foundation, or of removing rubbish, and carrying materials. Leaving those servile employments to the drudges in science, it plans a design, and raises a fabric. Some of this class of writers have, with an

abundance of ability and skill, endeavoured to prove the existence of a material world. Their success, however, has not been great: but, is it not surprizing, that men of deep thought should have conceived it of consequence to mankind, to prove to them by reason, that such and such things have existed, which mankind from the beginning of the world have believed, without being able to give any reason for them whatever? Poor untaught mortals have never doubted there is a sun, a moon, and stars; an earth which we inhabit; a country, friends, and relations whom we enjoy; lands, houses, and moveables which we possess. Common sense holds nothing of philosophy, nor needs her aid. On the other hand, true philosophy has no other root than the principles of common sense. Yet, some philosophers have discarded all secondary qualities; and by their means it has been discovered, that fire is not hot, nor snow cold, nor honey sweet; and, in a word, that heat and cold, sound, colour, taste, and smell, are nothing but ideas or impressions: at the same time, that these very ideas or impressions are inexplicable. Sensation and memory we call simple, original, and distinct operations of the mind: sensation, we say, implies the present existence of its object; memory, its past existence; but, imagi-

nation

nation views its object naked, and without any belief of its existence, or non existence; and is therefore what the schools call simple apprehension.* But here, excepting in the latter, the identity of the object is positively acknowledged. Yet, with much erudition, it has been attempted to be proved, that there is nothing in nature but ideas and spirit; and that consequently the system of materialism, on which so much has been said, is erroneous, no such thing as matter being in existence.

To what a situation do these men of wisdom reduce us! One denies all matter; the other denies all spirit; and so they very fairly bring us to nothing. The Atheist says, the soul is not distinct from the body, because it is subject to the same changes. But, what does this prove? Nothing more, than that if my mind is often modified by my body, my body is as often modified by my mind. There can be no solid grounds for insisting that all is matter, or that all is spirit. The truth is, there is between them a mutual dependence; at the same time, that it is more readily to be conceived, how spirit can act on matter, than how an inert substance like matter, can act on itself. Motion,

* Reid.

as we have frequently observed, can beget nothing but motion; for if it could produce a thought, the effect would be more noble than the cause. To make thought out of a local motion, is like making a god out of a stone or a stick. Number and colour, a triangle and virtue, free will and a pyramid, are not more unlike, or more distant, than thought and local motion. * Material, and immaterial substances, are both of them equally incomprehensible. "He," says Locke, speaking of water consolidating into ice, "who could find the bonds that tie these heaps of loose little bodies together so firmly; he who could make known the cement that makes them stick so fast one to another, would discover a great, yet unknown secret: and yet after that were done, he would be far enough from making the extension of body, which is the cohesion of its solid parts, intelligible, till he could shew wherein consisted the union, or consolidation of the parts of those bonds, or of that cement, or of the least particle of matter that exists; whereby it appears, that this primary and supposed obvious quality of body, will be found, when examined, to be as incomprehensible as any thing belonging to our minds, and

* Burnet.

and a solid extended substance, as hard to be conceived, as a thinking immaterial spirit."

The tenure by which the materialist holds his solid world, is frail: and a reflecting mind cannot but have it in disesteem, as tending to weaken the comforts of existence. No man rationally can suppose he obtains his ideas of figure, or any other of his ideas, from body alone. Sensible objects, though they be the destined medium to awaken the dormant energies of man's understanding, yet, those dormant energies themselves are no more contained in sense, than the explosion of a cannon is in the spark which gave it fire. Moreover, the materialist himself, who believes in the cohesion of matter, and its various properties and motions, cannot very well deny the possibility of the intervention of some active principle in the production of ideas in the mind, to which matter, in its apparent nature, is incompetent. No property of matter can resemble sensation, otherwise such property of matter would possess sensation. Scents and sounds do not resemble their respective causes, but are referable to motion. Figure, as discernible either by sight or touch, is known only by a variety of ideas or impressions, being included in one perception.

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At the same time, it must be allowed, that the doctrine which denies any such thing as body, is still more involved in absurdity than even the other. Can any proposition be more certain or more clear, than that there are bodies? No man can believe that the objects he has every where before his eyes, are nothing but spectres, or mere phantoms of the imagination. The materialist may demand of me, where the soul is placed in the frame? I answer him, I cannot tell. I feel it animate my body, but its particular situation is not to be ascertained. The spiritualist may tell me, that his arguments are irrefragable, and that he has demonstratively proved there is no such thing as solidity. I reply, he astonishes me. But I at the same time would ask him, whether he is seriously persuaded, that he has neither country nor parents; that he neither eats, nor drinks, nor sleeps in a house; but, that all these things are mere illusions, and have no existence but in fancy?

Spinoza founded a system, wherein he endeavoured to prove that the same substance is in all beings. Thus, in material things, says he, there is commonly no more than an identity of resemblance, that may be taken for an identity of substance. What we call the same body of

a man

a man at the age of fifty, contains no part of the substance which composed the body of the same man, when he was no more than six months old. But, this is an equivocation. The perception and knowledge we have of our own existence, enables us to say with the fullest and clearest conviction, I exist, I am, I think. I am one, not two. I am myself alone, not another. To object to this, would be to object to any thing being really what it is. Other philosophers say, that however we may be inclined to believe, there is yet no evident certainty of the existence of bodies, not even of our own; for a mind or soul such as ours, may feel the impression made on it by other minds, or by its own in particular. We consequently can have no certainty of what did, or did not happen to us yesterday. But, is not this trifling with common sense? For my own part, I am positively certain I was in the world yesterday. Their opinion, however, is, that I can have no evidence but by an internal perception of what I am thinking of at the moment, that is, of an actual thought, which is not the same as that of yesterday, and no longer exists to day. By a parity of reason, I must be still less certain whether I have not been in the world two or three thousand years; or whether I have not existed eternally,

nally, animating some body or other. It is evident I have no remembrance of any such thing; but, all this might have been without any actual remembrance of mine; as it really happens to each of us, to remain many months in the womb of our mother, without our having the least trace on our mind of any such matter. On the whole, sceptics may in vain object that they doubt whether they exist or not: it would be loss of time to attempt to convince them of their folly, by telling them, that if they doubt of every thing, it must be therefore true that they exist, for they could not doubt without existing. *

The utmost stretch of the human capacity has been exerted, but in a wrong method, on the fabrication of systems of abstraction. The builders of these edifices, have been rather poets than philosophers. They have fancied greatly, and have painted in the liveliest colours. When they merely dazzled, they were thought to enlighten. Their sketches of imagination, made them be looked upon as men of superior intelligence. Can any man, for instance, seriously doubt he is in being? He knows, certainly, he exists, and that he is something.

* Buffier.

thing. He who can doubt whether he be any thing or no, I would no more argue with, than I would with pure nothing; or than I would endeavour to convince non-entity, that it was something. If any one pretends to be so sceptical as to deny his own existence, (for really to doubt of it is manifestly impossible) let him, for me, says Locke, enjoy his beloved happiness of being nothing, until the cravings of appetite, or some other pain, convince him of the contrary. On this ground of doubting whether the ego of to day, be the ego of yesterday; or while I fancy I think, that it is some other thing that thinks, scepticism hath been wound to its highest pitch: it at a stroke annihilates all certainty, even of demonstrative truth and knowledge; and sends forth mischief unfettered on the world. But, is it not the very essence of extravagance to suppose, that Almighty God should have given us so splendid an apparatus of senses; should have made us so capable of investigating the nature and method of sensation; of seeing the contrivance and wisdom, and the relation between the object and the faculty; and all this only for the purpose of deceiving us into a belief, that these are organs for communicating the action of external objects, when in truth there are no such thing? Can it be supposed, that

God

God is under a necessity of constantly deceiving his creatures? He who asserts there is no such thing as body, can from such premises injure nobody, let him be ever so bad, and therefore theft, murder, or adultery, are to him nothing more than phantoms of the imagination. Monstrous absurdity! and how grievous that rational minds should think all was performed in shew only; and that our ignorance was laid hold on, to raise our amazement. *

Berkley, the celebrated Bishop of Cloyne, with the pious design of destroying the strong holds of Atheists, erected entirely on the doctrine of materialism, first broached the hypothesis of the non-existence of matter: for he thought, if he could shew that matter did not exist, it would follow as a necessary consequence, that there was nothing in the universe but mind. It is said, indeed, his arguments did not go altogether to prove that matter had no existence; for in regard to substance, says he, "I can as well doubt of my own existence, as of the being of those things which I actually perceive by sense; it being a manifest contradiction, that any sensible object should be immediately perceived by sight or touch, and at the same time, have no existence

* Baxter.

existence in nature. But, at the same time, it is plain, there is not any natural efficient cause, distinct from mind or spirit: for we are not to conclude, that because things are unperceived by us, they have no existence; or that there may not be some other spirit that perceives them, though we do not." Berkley caught this idea, it is probable, from the writings of Descartes and his followers, many of whom insisted, that the spirit was the man, and not the body and the spirit conjointly. His system evidently went to the denial of all existence but mind; rejecting not only secondary qualities with Locke, and solidity with Boscovick, but also extension, figure, action and motion, as external beings; making all these, ideas only, and wholly within the perceiving mind. His fundamental position is, "that we can perceive nothing immediately but our own ideas." But, this cannot certainly be correct. When we speak of an object of perception, or a thing perceived, we distinguish between the object and the perception; between the thing, and the perceiving that thing. If we perceive ideas, ideas must exist, distinct from our perception. But, our author, in another place, insists, that ideas have no existence otherwise than as perceived: then, if their existence consists in being per-

perceived, they are not distinct from the perception; but, if not distinct from it, they are the very perception itself. We do not then perceive ideas or sensations, these are the very perceptions, not their objects. To have an idea, is to perceive, but it is not to perceive the idea; the idea constitutes the perception. Since, therefore, we cannot be said to perceive any idea, we must in every idea perceive its cause, and by the perception of the cause acquire the idea. Thus, since things which are not ideas do exist without us, namely, the actions which produce ideas, there are external existences, independent of our perception. He who denies that a material world exists without him, a globe of earth, stars, planets, mountains, trees, houses, and the bodies of animals, must of necessity deny the powers with which these corporeal forms are endowed. If no sun, nor earth, nor gravity to preserve the system; if no vegetable world, no principle of vegetable life to govern it; if no bodies of men, no souls to inform them, he must be himself the only object in the creation (yet his own body merely an idea) a solitary creature, to whom the Supreme Mind has thought fit to impart a certain order of ideas from

* Gent. Mag. 1788.

from his own essence, presenting to him the glorious picture of the universe.*

But, let me again ask, does not the supposition of every thing being spiritual imply thought? and does not thought imply existence? Seriously speaking, did ever any of these immaterialists take lead when he should have taken gold: drink milk and think it wine: or eat arsenic and think it bread? The most doughty of these refiners would not prefer a bad bargain to a good bargain; he would not receive an outrage and look upon it as a compliment; nor would he conceive a blow, or a hearty drubbing, the greatest good that could befal him. The airy system of the spiritual philosophy owes all its charms to the novelty of the conceit, and to the high working up of the imagery and the style. Despoil it of these;—Where is the brilliant and the pompous edifice? Vanished into the regions whence it originated. It no longer has being: and therefore with Descartes we may say, "I think, therefore I am." Or, as we have already more philosophically said, "I am, therefore I think."

* Young's Essay on Nat.

Abstract reasoners, wise in their own estimation, first raise thick clouds of smoke, and then complain they cannot see. I cannot believe it; I will not believe it; it is impossible; are all words in very familiar use. To renounce sensitive knowledge, is in some sort to renounce humanity, and to place ourselves in some unknown rank, either above it or below it. Did ever a man, crossing from Switzerland into Italy, doubt in good earnest, that there existed such a cluster of mountains as the Alps? The metaphysician fondly imagines, he is certain and clear in his opinions. But, notwithstanding all the subtilty of his deductions, every man of common penetration will wander agreeably to the dictates of his own senses. One will go and find perfume in a rose, independent of perception; another will find coolness in the brook; another will find solidity in the oak; this will find sound in an instrument of music; and that will see colours in an evening sky. None will believe the word of a philosopher, that these things are not what they seem; that it is in the mind only, where sensation dwells; and that they ought to look up to this, as the sole source of pleasure and of pain.

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The unlearned definition of personal identity, or what it is that constitutes a man the same being at any one time, that he was a month or a year before, I would say is, that it is the same thinking, intelligent substance, united to the same human body: not, indeed, altogether the same body, composed of the same particles of matter, but being of the same human structure and form. To sceptics who doubt of this personal identity, we may fairly apply Lucan's saying of the academics. Speaking of the happy island, and telling us in what manner it was stocked with the several sects of Greek philosophy; when he comes to the academie, he observes, that though they were in as good a disposition to enter as any of the rest, they still kept aloof on the confines, and would not venture to set their feet upon the island. And what was their reason? Nothing more, than that they still doubted whether it was an island or not. The disputes of metaphysicians, resemble the children's game of blind man's buff: every one is blind in turn, and the rest endeavour to drive him into some blunder. In speculation, it is true, it may be of little consequence on which side the error lies; for abstract doctrines have little weight on the practice of the world. But, is it possible to conceive there is

any way of seeing without eyes, or feeling without fingers: that the sky is not of variegated colours: or that sugar is not sweet? That there is no bulk or size in nature: that the large, the mediate, and the small, are the same ideas in every different scale: the smallest berry being, in relative mensuration, no less in actual bulk than the largest planet? That every part is as large as the whole; and the whole as small as a part? And, in a word, that relative proportion appertains solely to the mind?

The objects of sense are not thus delusory and vain. At the same time, we have had abundant proof, that there exists a subtile agent independent of body, and divested of all materiality. In regard to both, therefore, it is evident and demonstrable, that solidity is as necessary to matter, as perceptivity and activity is to spirit. Let us reason soberly, therefore, and acknowledge, that though the evidence of sense is not the greatest we are capable of, yet, since it is the most universal and constant, fitted to all the concerns of life, and the capacities of all men; since there is a satisfactory agreement between its informations, through all ages, and in all countries; and since it is in effect, the first foundation of all our knowledge, in our present state

of

of union with matter; the man who endeavours to overturn the evidence of sense universally, introduces the most unbounded scepticism that ever was promulgated. Can he, who believes there is no such thing as a solid, resisting, figured substance; no material world; no such beings as men, compounded of body and spirit; can he ever propose, consistently with his belief, to dispute with men, or to propagate his doubting among them? He knows not what things they are, which he would convince, or if there be any beings differing from him in opinion: for all these ideas that are excited in him, as of beings maintaining the contrary of what he maintains, may be only ideas raised in him, by some spirit that hath a design to impose upon him. What greater evidence has he for the existence of other men's souls, than of their bodies; though he may have more for that of his own? Besides, he has nothing but ideas, or dreams, when he either speaks or writes. How does he pretend that these dreams of his should be communicated to other beings, granting that they existed? In short, his whole system proceeds upon the supposition of the reality of what he is going to confute. Thus he puts it into his adversary's power to prove from the very nature of his attempt, that he doth not be-

lieve himself, and so to confute him, without the use of any other arguments.*

The ancient sceptics, the followers of Pyrrho, pretended to give a demonstration, to prove that no demonstration could be given. They took away all demonstration, all judgment, cause, motion, learning, generation, and denied that any thing was good or evil by nature. † A singular inconsistency this: for if their demonstration were true, the design of it was defeated; and if it were not true, the design of it was still defeated; and, at any rate, they could not believe themselves. Moreover, the very denying, was an acknowledgment of the existence of things; otherwise, there could be no reason for denying. Thus, they affirmed, that we could not affirm there are four elements, because there are four elements; that things were hot and cold, not from any natural quality, but from law and custom. And thus that Demophon was cold in the sun, and warm in the shade. Is not all such reasoning as this, a step or two beyond the boundaries of sanity? Metaphysical researches, it is certain, are not easily to be fathomed, and that which appears to me unintelligible, may perhaps have that appearance from my own insufficiency. But, yet

* Baxter. † Diogenes Laertius.

yet I cannot accede to a kind of refinement which fritters every thing away,—a series of principles which are to me incomprehensible. The human intellect soars a vast height; but, it sometimes goes too far: and I am very apt to suppose, that what we in humility would impute to our own dulness and incapacity, when we do not understand certain doctrines, is perhaps very often with more justice to be ascribed to the doctrines themselves, which at their origin were unintelligible to their authors.

But, if on this subject much doubt has arisen, what shall we say to that prodigious leap which there is from Berkley's doctrine, that all is ideas, to Locke's, that there are no innate ideas? Locke borrowed his system from the doctrines of the stoics. "The spirit or mind of a man at his birth," said they, "is like a white unsoiled paper, disposed to receive whatever characters may be written upon it; and the first impressions it acquires, come from the senses." *

* Plutarch.

LETTER LV.

TO talk of abstracting ourselves from matter, of laying aside body, and of being resolved as it were into pure intellect, is trifling, and unmeaning sophistry. Nor is the opposite system of material ideas, less injurious to mankind, when considered without prejudice. The faculties of sense and of reason, I am aware, are very little capable of acting upon themselves. The eye, is not accessible to the sight; nor the soul, to the intellectual idea. The mind, cannot be an object to itself. It can contemplate the body which it inhabits; it can be conscious of its own acts, and reflect upon its own ideas; but, of its own substance, it can have no adequate idea; it cannot be at the same time, both object and spectator.

All our thoughts, say the disciples of Locke, are corporeal images; nor of the most abstract ideas, are there any which are not conveyed

veyed through the senses: there is not throughout all nature, a work of the pure intellect. If we desire, for instance, to form an idea of the Deity or his attributes, we consider him under human relations; at one time, as a beneficent father; at another as a glorious king; now as a benevolent master; then as an offended judge. He, who would contemplate him in his essence, without the aid of corporeal images, perceiving no relation between God and himself, knows not how to form any notion of him, and is lost in the sublimity of the idea. Thus when we form a notion of the soul, we ever represent it, as a thin shade or subtile matter; in short, as a corporeal being. Darkness and confusion, ever attend an attempt to form ideas wholly intellectual, or to conceive pure spirituality.* This is in some degree true. But, it is going too far, to assert, that mind is *younger* than body. Such assertion, virtually banishes original mind and wisdom from the universe. It puts matter before intellect. At the same time we cannot but allow, that whatever ideas, we may latently possess in our minds, we probably gain no actual knowledge of them, but as they are awakened in us by external impressions, observations, and successive experience.

* Essay on Man.

Philo-

Philosophers, notwithstanding their unanimity, as to the existence of ideas, hardly agree in any thing else concerning them. Plato imagined, that we see only the shadows of things, and not the things themselves. The Peripatetics thought that we do not perceive objects, but only certain sensible species transmitted from them. Des Cartes, Malebranche, Arnauld and Locke, thought it necessary to prove by the strongest deductions from argument, the existence of material objects. Berkley denied the existence of an external world, and of abstract notions. Hume denied, that there is either space or time; body or mind; or any thing else but impressions and ideas; and moreover maintained, that no one proposition is more probable than another. Such paradoxes, must create in the minds of unlettered men, a prejudice against all theories of ideas. It is not to be explained, how we perceive external objects; nor is it to be explained how we are conscious of those that are internal. Perception, consciousness, memory, and imagination, are all original and simple powers of the mind, and parts of its constitution. Every man feels, that perception gives him an invincible belief of the existence of that which he perceives; and that this belief is not the effect of reasoning, but the immediate consequence

quence of perception. When philosophers have wearied themselves and their readers with their speculations upon this subject, they can neither strengthen this belief, nor weaken it; nor can they shew how it is produced. It puts the philosopher and the peasant upon a level; and neither of them can give any other reason for believing his senses, than that he finds it impossible to do otherwise. *

The doctrine of the Stoics, which endeavoured to prove the materiality of our ideas, was not generally acquiesced in by the ancients: On the contrary, it was warmly combated; especially by the Pythagoreans. The founder of this sect, insisted upon innate ideas. The sciences preparatory to philosophy, he termed Μαθήματα, upon the principle, that all mathesis or discipline, is reminiscence, and not an extrinsic derivation from sensible objects; that it arose from intrinsic phænomena, and not from any external impressions. † Plato, took almost his whole philosophy, and particularly his doctrine of ideas, from the Pythagoreans. In his opinion, ideas are one of the three principles of things, that is, the idea, the matter, and the body, which falling under the senses, is the produce of the

* Reid's Eſſays. † Proc. in Eucl.

two

two first. Ideas, he maintained, not only existed separately, but that they made a part of the divine nature. In like manner with Aristotle, his pupil, he contended for those perfect ideas, or species of things, which exist in the mind of the Deity, and in which every thinking man, who believed the universe to be the production of mind, and not of blind chance, equally concurred. Those previous forms, as Mr. Harris calls them, which are truly eternal and unchangeable, and may be said to have a real existence, in contradistinction to corporeal forms, which are fleeting and perishable, and in a constant vicissitude of generation and corruption. He even went farther, and maintained that those ideas or species of things, had a real existence by themselves, not only out of any corporeal form, but, out of any mind or intelligence: that they were incorporeal substances, not accidents, or qualities of other substances: that they mixed with every thing here below: and that it is by participation of them, that every thing is denominated to be what it is. But, what the nature of this participation is, or how it is to be conceived, that one simple indivisible idea, existing as a substance by itself, should mix and incorporate with so many different masses of matter, and yet still preserve the unity and indivisibility

of

of its nature, is one of the mysteries of the Platonic philosophy, which neither he, nor any of his followers, have ever been able satisfactorily to explain.*

To discuss what our understandings are, and agreeably to the stoic hypothesis, so ingeniously revived by Locke, to discriminate the parts of which they are composed, would be a very idle, and a very endless labour. We do not dissect the leg, to learn how it walks. Our reason, and our legs, perform their functions without anatomizing. But still, it is said, mental faculties proceed from material causes. The mind is a *rasa tabula*, says Aristotle, and there is nothing in the intellect, which does not come by the way of the senses. "Nihil est in intellectu, quod prius non fuerit in sensu." Let us here, however, ask these philosophers, whether they will allow our passions to be innate, such as love and hatred, hope and fear, desire and aversion? These passions are the internal sense of the soul: and I suppose they will grant, that external objects cannot create sensation where there is no inward innate principle of sense, for that would be to create life by external impressions; and it is certain these internal passions are not imme-

* Monboddo.

immediately raised by external objects, but by our imaginations, and opinions of things. Is it reasonable, therefore, to think that God has implanted in us natural passions, which have good and evil for their objects, but has implanted no natural ideas in us of good and evil? We might as well suppose, that God has made eyes, but made no light; that when there is a natural proportion between the passion and the object, and a natural relation and connection between them, one should be the work of nature, but not the other.*

We might further ask those who insist upon this doctrine, why external objects do not form the same notions and ideas in the minds of brutes, which they do in the minds of men? Brutes have sense and perception, and external objects make the same impressions upon them, as upon us. Hence, if the soul of a man hath no more innate knowledge than the soul of a horse; but, that all notions and ideas come from without, and that the quadruped receives the same impressions from without, that the man does, why should not the same impressions, convey the same notions to souls, equally void of all natural ideas? Or why, if ideas were not con-

* Bishop Sherlock.

connatural to human souls, should not the brute from the images of external objects, become a mathematician as great as the immortal Newton?

The mind is not a *rasa tabula*, though, at the same time, it must be allowed, we gain no actual knowledge of the latent ideas which it possesses, but as they are awakened by reflection and experience. In the human frame, sensibility is first unfolded, next instinct, then memory; after these, the understanding; and last of all, the will. All the faculties are rendered active, a short time after birth; but, a considerable space of time passes, before they are perfectly developed. The infant at first, has only particular sensations; objects appear unconnected: when the number of these sensations, however, are multiplied, the child compares them; perceives their identity or difference; begins to range them in certain classes, according to analogy, and to form ideas. From this instant, the innate desire of happiness has its determinate object, and the will pursues some known good.* Is not an animal, also, in general brought forth with every one of its external members? And does it not complete its growth, not by the production

* Essay on Man.

duction of any new member, but by addition of matter to those already formed? The same holds good with respect to internal members: these are coeval with the individual, and are as gradually unfolded.

For a moment contemplate the workings of your own mind. Do you not find that all notions and ideas come by reflection; that is, by turning your eyes and thoughts inward upon yourself? Now, why should you consult your own mind, if there be no characters of truth, no ideas of things to be found there? If our ideas and notions came from without, they would be as immediately printed upon the mind, as the objects of sense are: the soul would be wholly passive in knowledge, as it is in sense: and all men's notions would be as exactly alike, as their sensations are. Whereas, we know that truth is not discovered, without difficult and laborious research. Men turn over their minds, and examine all the ideas they can find there, till they hit upon such a train of thought, as like a clue leads them to those secret recesses, where such ideas are to be found: which is the reason why men differ so much in their notions of things; that some men are ignorant of the most useful truths; that others see but a little part of them;

them; but, that others have distinct and clear notions, which they assent to without doubt or hesitation. *

Mind is the most ancient of things, says Plato: it alone has activity, the principle of motion, and is the efficient cause of every thing. There are ideas, indeed, which are of a much higher order than those which we abstract from matter, being the models, or archetypes of all material forms. Of such ideas, the intellectual world is composed, of which the material is no more than a copy. There are other intelligences, also, in the universe, besides ours, and infinitely superior to ours; and One, the highest of all, in whose intellect resides that intellectual world, and who is not only the efficient cause of all things, but, virtually comprehends in himself every thing existing. † Locke, however, makes mind, in contradistinction to this, so dependent upon body, as not to operate without it, and to know nothing beyond sensation, and the ideas of sensation, as he calls them. But, to what dreary consequences does not this lead? It is an irksome thing to say, but the truth must not be suppressed, that there is scarcely any objection

* Bishop Sherlock.

† Plato in Epinom.

to the belief of a God, more formidable than to teach that mankind are made without any connate natural impressions and ideas of their Maker; or of good and evil: for if all the knowledge we have of God, and of good and evil, be made by ourselves, Atheists will easily conclude, it is only the effect of education, and superstitious fears; and satisfy themselves, they can make other notions, more for the ease and security of life. This at least is certain, that no man who believes the idea of God, and of good and evil, were originally impressed upon our minds, when they were first made, can doubt, whether there be a God, or an essential difference between good and evil.

Our natures differently cultivated, says a late intrepid writer,* decides our faculties both corporeal and intellectual,—our qualities both physical and moral. Our temperament, says he, is the effect of physical substances; our habit, of physical modifications; and the opinions, good or bad, true or false, which are arranged in our minds, are nothing else than physical impulses received through the medium of our senses. Thus, to insist upon a man's thinking as we do, is to insist upon his being organized as we are; upon

* Mirabaud.

upon his being modified like us in all instances; upon his having received the same temperament, the same nourishment, the same education; in a word, upon his being ourselves. Why do we not go farther, and insist upon his having the same features? The fact is, organization is more powerful than religion. Present objects, interests of the moment, rooted habits, the opinion of the public, all these have a more powerful influence on man, than any consideration of imaginary beings, or any speculations, which do not depend upon organization. And hence we find that men frequently of the best theory, are of the worst practice; and that others of the worst theory, are of the best practice.*

All created beings have certain principles, necessarily innate. If it be allowed that ideas are not innate, it will follow that no proposition can be innate, but not that we have no innate principles; for the moral principles are the foundation of our moral ideas, and must exist prior to them. By principles, we are to understand such properties, qualities, energies, or laws, as are necessarily inherent in any being, and constitutes its nature. The general laws, by which every

* Systême de la Nature.

species exists, is moved, and acts, are the general principles of that kind: the particular laws, by which every species exists differently, and is moved and actuated differently, are the particular principles of that species. Very different from these, are those beginnings of human reasoning, data, axioms, maxims, rules, &c. which are sometimes called principles. These are only inventions of the human mind, to assist its progress in the search of truth. It is no objection that the ideas of knowledge arising from them are progressive. Do we say that the sense of hearing is not innate, because we are not born perfectly accomplished in music? That our sight is not innate, because we are not born opticians? Certainly not. Why, then, should we presume that our consciences are not innate, because we are not born moral philosophers? Time, and experience, must be allowed to all. God hath created both minds and bodies capable of progression, and not perfect or full grown. To object against any one of the faculties as not innate, because it is not born in a perfect state, or full grown, is only to object against it, because it is not, what it was never intended to be: and the same objection may as reasonably be made against the innateness of every part, or faculty of a man's body.

In

In the human mind there is an early anticipation, neither derived from experience, nor from reason, nor from any compact or promise, that our fellow-creatures will use the same signs in language, when they have the same sentiments. There is another principle implanted in us by the Supreme Being, a disposition to confide in the veracity of others, and to believe what they tell us. This is unlimited in children, until they meet with instances of deceit and falsehood; and it retains a considerable degree of strength through life. Every operation of the senses, implies judgment or belief, as well as simple apprehension. Thus, when I feel a violent pain in my head, I have not only a notion of pain, but a belief of its existence, and a belief of some disorder which occasions it; and this belief is not produced by comparing ideas, and perceiving their agreements and disagreements, it is included in the very nature of the sensation. When I perceive a tree before me, my faculty of seeing gives me not only a notion or simple apprehension of the tree, but, a belief of its existence, and its figure, distance, and magnitude: and this judgment or belief is not got by comparing ideas, it is included in the very nature of the perception. *

* Reid's Enquiry.

We have taken notice of some original principles of belief; and when other faculties of the mind come to be examined, we still find many more such original and natural judgments, which are absolutely a part of that furniture which the God of nature has given to the human understanding. They are the inspiration of the Almighty. They serve to direct us in the common affairs of life, where our reasoning faculties would leave us in the dark. They are a part of our constitution, and all the discoveries of our reason are grounded upon them. They make up what is called the common sense of mankind, which is universally found, even among those who are not acute in reasoning. And hence, the man who suffers himself to be reasoned out of the principles of this common sense by metaphysical arguments, may very fairly be termed a metaphysical lunatic.*

It is loss of time, and in itself, perhaps, a thing infinitely ridiculous, to attempt the improvement of our minds, by making long searches after the origin of our ideas; and by profoundly meditating upon the nature of common sense. I do not doubt, but every thing is mechanically executed in the motions of the body,

* Reid's Enquiry.

body, since all the actions of it are assisted by cords and strings, by impulses and refractions, in short, by a variety of instruments of communication. But, this sort of mechanics is as much beyond my reach, as is the mechanism of the universe. My activity is indeed a noble gift; but, the manner of its beginning and continuance is incomprehensible to me. My understanding is an inestimable favour; but, I cannot conceive what that principle and tie is, which causes men, who never saw one another, to unite in adhering to one and the same truth, and to one and the same set of common ideas. The activity of the body, and common sense, are two instruments we have been provided with by the Divinity. They need only be made use of, without attempting in vain to understand the communication of the muscular motions, or to perceive distinctly, the source of our conceptions. *

Ideas, are the production of mind, genuine and pure, without any mixture of body and its operations. But, as I have already said, there is a progress in them from capacity to habit; and the faculty of combining ideas, is like other faculties, which are brought to perfection by ex-

* Spectacle de la Nature.

perience and use. On various occasions, we have adverted to the inertia of matter; its motion and cohesion. But, we cannot give to intellect, solidity, figure, and divisibility; nor can we speak of the vis inertiæ of ideas; the motion or gravity of ideas; or the elasticity or cohesion of ideas. Such reasoning would be monstrous. Are our ideas, quantity? No man ever spoke of a circular thought; a spherical or triangular perception; or the sine and tangent of a sensation. Nor did ever philosopher venture to call our ideas a fluid, heavy or light; projectile or resisting; dilated or compressed. How ridiculous would it be to state, that the centrifugal forces of two equal ideas, revolving in the same time, in unequal ideas, are as their distances from the centres of these ideas: or that the volumes of compressed ideas, are reciprocally as the weights of the superincumbent ideas: or that the spaces run over by an idea, falling by its own gravity, are as the squares of the times?*

The mind forms ideas, without any assistance from the senses. With respect to ideas of reflection, this is beyond dispute, for the senses do not so much as furnish the materials out of which they are formed. We likewise know it from

* Baxter.

from oral communications one to another, on subjects too metaphysical ever to have been connected with body. Unsubstantial ideas such as these, and given in unsubstantial words, cannot be the result of material impressions. And in regard to the ideas, which are said to arise from sensation, they are simply the product of materials furnished by the senses, and upon which the mind works by itself, and forms them into order. Sense cannot compare, or perceive certain relations, and therefore, this comparing faculty is the peculiar property of the intellect. But let me ask, what is the sentient faculty? Must there not be sense in the soul, to make it capable of the external impressions of pain and of pleasure? And by parity of reasoning, must there not be knowledge in the soul, to make it capable of knowing external objects? There is no thought in the world, but in minds; and therefore all the things in the world cannot put a thought into us: they can only raise thought. Thus, as no thoughts can come into us from without, we must find them all within; and what is within belongs to our nature, and has always been there in embryo, though it was not sooner discovered.

Locke,

Locke, indeed, in some respects, it may be believed, and let me be pardoned for venturing to say so, mistook the question. He supposed that innate ideas must be first known, and must be known by their own light, without being taught; without any labour or search of the mind; without the use of reason, experience, or observation, or any external notices to bring them into view; and therefore must be as perfectly known to children, to ideots, and to savages, as to the wisest men; nay, much better, because they have no prejudices or prepossessions to tincture and discolour their minds. Such innate notions as these, I must grant, we have not. No man of common reason, could ever have supposed we had. The wisdom of a philosopher, is not to be expected in the innate capacities of a child. But, at the same time, it is evident, that most of the certain and useful notions we have, are innate, however, after-knowledge may be to be acquired. This acquired knowledge, we may also say, is not the forming and making notions, but the finding them: they were in the mind before, though not seen and discovered. This Locke mistook for what he called making ideas; and thought it a sufficient confutation of their being innate, if

* Bishop Sherlock.

if he could shew by what means we may come to know them: whereas, those who insist upon innate ideas, may allow them to be discovered, nearly in the same way in which Locke supposes them to be made.

In the classes of animals inferior to that of man, we distinctly perceive that their memory is limited within a very small compass of functions and reiterated signs. If you take them out of this track, you no longer find any sensibility, or reminiscence in them. But, the memory of man, is in a manner as extensive as nature itself. It is a vast repository, wherein he ranges in the best order, the names, figures, and properties of animals and plants, and of whatever has a form or use in the wide circle of creation. This amazing variety is far from causing confusion. The faculty of recalling to the mind the things seen no more, is always stronger, in proportion as it is oftener exercised. The monuments of the history of each nation have bounds; but, the memory of man has none. What it has once admitted in good order, is a deposit it keeps. But, what corner of the brain, as I have repeatedly said, serves for this deposit? Nay, what relation is there between ideas and a brain? What vessels, or what streams

streams of spirits, can possibly assist these ebbings and flowings of thought? What is it can awake them from a sound sleep, and immediately lull them into repose again? What can animate all those services with so much variety and expedition? *

Man prides himself, says a paradoxical writer, † in the idea, that he has more intelligence than other animals; and the reason is, because he alone can compare, fabricate, and communicate. But, if elephants, beavers, ants, and spiders, could communicate the wonders of their daily atchievements, man would soon learn to be less an egotist; and would most certainly improve himself, from the superiority of their labours. From such sources, indeed, he would learn something that might be worth the speaking of. Are not such creatures endowed with much more instinct than we are? Are they not furnished with more sagacity and intellect? Providence, in his mercy, surely will some day or other have pity on human infatuation; and will renew the miracle he manifested in the ass of Balaam. Animals on four legs will then speak; and will then foil bipeds in disputation. Who then will be the greatest brute? In the internal

* L'Abbe Pluche. † Alembic Moral.

internal construction of man, there is nothing that is different from the internal construction of a quadruped. In all nature, there is not one species which is created better than another, or with any absolute superiority. Why, in truth, should God have made a difference, and have made one species excellent at the expence of the rest? Man has indeed a thousand times more perfections than a sheep, but, has he not also a thousand times more imperfections?* To all this, I can only demand in my turn, why should God have created the sun to rule the day, and the moon with inferior lustre to rule the night?* It may, indeed, be retorted, you are a spiritualist, and if therefore material substances are to be reduced all to the same consistency, why should not immaterial ones be reduced to the same consistency? Here, I cannot presume to reply, more, than that it is as evident the difference between the spirit of God and of man must be infinite, so may the gradations between the intellect of man and inferior animals be infinite. The Power that created all, must be acknowledged capable of modifying all. He who could diversify the various species and faculties of beings, could also diversify the immaterial essences.

* Robinet.

sences. And, in fact, though it be acknowledged, man may degrade himself, even below the level of brutes, it yet is not clear that brutes can elevate their understandings to the level of the human capacity. In the individual, the superiority of nature may be often obscured: in the species, it is never to be annihilated. In short, it is contemptible in man, and I am concerned there should be real occasion to say it, —to doubt of the superiority of his own faculties.

Of all the faculties which help our thoughts, memory, upon Locke's system, must be the grossest and the most material. It is simply, according to his doctrine, a matter, apt to receive a variety of impressions. That which produces memory, say his disciples, is nothing but a stream of animal spirits, which imprint their own stamp, more or less deeply in that matter, according as they are more or less abounding. They form a picture there; and when new spirits run into the same engraved strokes, the same images offer themselves to the mind again. Nothing, say they, can be more plain or natural. But, let us beseech these philosophers to tell us,

what

what can the image of a savour be? What the length and breadth of a sound? Could the pencil of Poussin, or of Raphael, represent the smell of a jasmine, and distinguish it from that of a rose? Has a colour any outlines that can be delineated? According to what direction must the spirits stream in the brain, there to draw the purple rather than the orange colour? There is no image but what has its dimensions, yet the major part of our sensations, having no lineaments or dimensions whatever, what can the images of them be? *

Genius is often fettered by prejudice; and it is not uncommon to see the finest abilities constrained by the authority of system, to a perpetual round of repetitions, and an hardiness of hypothetical conjecture. Locke himself was in a great degree tainted with this malady, though no one was more sensible of the unlimited freedom which the human understanding should have, in the progress of its researches. While men stick in words of undetermined and uncertain signification, says he, they are unable to distinguish true from false, certain from probable, consistent from inconsistent. Thus, the increase

* L'Abbe Pluche.

crease brought into the stock of real knowledge, has been very little, in proportion to the schools, disputes, and writings, the world has been filled with. Had men in the discoveries of the material, done as they have in those of the intellectual world, involved all in the obscurity of doubtful terms, we should be as blindly ignorant at this hour, as our forefathers were two thousand years ago.

I agree entirely with this great man, in this statement of the question. But, did his own reasonings at all times help us on the way, or point out the lucid path, which would conduct us from this obscurity? I confess we have no immediate knowledge of the soul; and that all we know of it, is by its faculties; nor are these known to us any otherwise than by their effects. Man, however, can perceive objects which are not cognizable by the senses; he has, therefore, a sensibility distinct from that of the body. He can compare his sensations, and determine their relation and difference; he has therefore a faculty of judging. He retains the sensations and ideas which he receives; he is therefore endowed with memory. He possesses freedom of choice; and therefore he has will.

But

But besides these faculties, the soul has another, which is of the utmost importance, although it is not always enough considered. It has a natural bias towards particular objects, independent of, and prior to all knowledge, and which is the same with that which in quadrupeds and other animals is called *instinct*. This principle, at least, it will be allowed, is inherent in man. It was given us to regulate our actions, till reason should be sufficiently unfolded; so we find, that in proportion as reason appears, instinct vanishes; and in those actions which it afterwards directs, (as we seldom examine what passes within us) we are unable to distinguish such as are to be attributed to reason, from those which proceed from instinct.

Life, we must believe to be nothing else than conscious perception; either knowledge or sense. How then can a living nature be without natural knowledge? For if all knowledge comes from without, life itself must do so, if knowledge be life. Life is an internal principle of perception, which can never be without the internal seeds and principles of knowledge, or of sense. But, not to insist too much upon abstract ideas: man, at his first coming into the world, is feeble, helpless, and entirely devoid of

knowledge; that is, his senses are not yet developed. By exercise, these unfold, and are perfected. In the early parts of life, instinct alone regulates his actions. It is not owing to learning, or to experience, that infants apply themselves to their mother's breasts; that they put things to their mouths; or that they extend their hands to such objects as please them. It is not reason which teaches them to shrink from fire, when they first feel it to burn them. When hungry or thirsty, how came they to know that eating and drinking would satisfy their cravings?

This problem, I should apprehend, cannot be solved by those who would deduce every thing from reason and experience. With such factitious reason, but without instinct, the human race had perished. But, it is said, the infant imitates the animals by which it is surrounded. Let us suppose this, is it not evident that this propensity to imitation must be innate, and prior to all knowledge; and how came he by this propensity to imitate? Beside, does not this theory ascribe to man a knowledge he could not have as yet acquired, a knowledge of the physical relation between his nature and the nature of other animals? A knowledge, likewise,

wise, which could enable him to judge, while imitating the goat, of the propriety of following her, while brouzing on the tendrils of the vine, and not when she cropt the hemlock; for otherwise he would have found a poison, where he sought a food? *

Birds, beasts, reptiles, insects, in short, the whole animated creation, have, as soon as born, an intuitive knowledge. Have they innate ideas, and shall man be denied them? Locke allows the soul to be a rational intelligent principle; and endeavours to shew how a rational soul, which has a natural principle of understanding, can form its own notions, without any natural or connate ideas. Now, I can no more understand how a soul, which has no rational ideas, should have any principle of reason or thought, and therefore, should ever absolutely think, than I can how that which has no natural heat should ever warm or burn: for the principle and the act are of the same kind; and that which can think, must have some natural thoughts or ideas, which can be brought in to act, and are the natural seeds and principles of thinking.

* Essay on Man.

The law of God is written on our hearts; not indiscriminately, indeed, and on all hearts alike, otherwise there would be no dissimilarity in the ideas, and in the opinions of the several nations of mankind. Men, in such case, would be like other animals, born with certain instinctive faoulties, and never be enabled to get beyond them. But, we know that soils which are to be improved by cultivation, are various. The earth is not every where alike, and every where capable of the same products; neither is the mind and the intellect of man. In these soils, however, are the seeds and the principles of knowledge. They are those connate germs which grow into intellect, and burst into thought. This climate and this situation are the best adapted to the peach and to the nectarine; that climate and that situation are the best adapted to the cocoa and to the tamarind. Material substances like these are readily propagated, though, at the same time, they must have had an existence with the origin of things. So is it with the immaterial intellect or mind. Mental fruits are the result of care and culture. The knowledge transplanted from one mind to another, is merely the acquirement from cultivation; from a cultivation of principles, which must have had

their

their being co-ordinate with the creation of the more material parts of the human frame.

No true notion is to be formed, but what is founded in some connate idea. All eternal verities, which have a necessary or immutable truth, whether they be first principles and maxims of reason, whether they be abstracted and intelligible ideas of some real things, or whether they be necessary and unavoidable conclusions of reason,—are innate. All men are sensible they do not make such notions, as always were, and always will be true; and yet in these consists the certainty of our knowledge, and that universal consent which is in mankind; both of which would be impossible, had men the making of their own notions. We readily acknowledge such truths as soon as we see them, as the eye acknowledges the presence of light and colours, and their influence. All men who see them, see them the same; which is the only universal consent we can urge, to prove any thing natural or innate. All eternal truths, therefore, had a being before our minds saw or discovered them. Demonstrations of mathematics, and the powers of numbers, always were, and always will be true and real ideas of something possible to be, whether we see or know

them, or not. In a word, those ideas and notions, which, as soon as we perceive them, by what means soever discovered, and which we see to have a necessary and eternal truth, are evidently truths and ideas not made by us, but merely found out, and treasured up in our intellect. Nothing can warrant the assertion, of the mind's having a power to make an idea or notion, which as soon as it has made, it must acknowledge to be eternal, and therefore never made. *

There are no ideas in the universe, but either in the eternal or in created minds. Ideas and notions can subsist only in mind. † If, therefore, there be no ideas but those of mind, we can find those ideas only in our minds; and if they are to be found there, and no where else, they must be innate. It is as credible, and as intelligible, surely, that we should have knowledge by innate ideas, as that we should have instinct by innate sensations. But, the fact most probably is, that it is the soul only which sees, hears, and feels, as well as understands. This represents the soul, indeed, as a true *microcosm*, or intellectual image of the world, imbued with all those principles and germs, which, though not

* Bishop Sherlock. † Cudworth.

not actual knowledge, are yet of the capacity of knowing, because they are capable of being brought into action.

Upon the whole, so very dissimilar to a *rasa tabula*, is the mind of man, that I cannot but look upon it as a most beautiful and convenient structure, with all its necessary furniture and utensils arranged in their proper places. At first its doors and windows are shut up; all is dark within, and *reason*, its owner and inhabitant, lies asleep. As soon, however, as it is thrown open to the outward light, reason begins to rouse by degrees, and look about her, yet knows not the uses of the apartments or the furniture, till she is taught their convenience and fitness. In ignorance, indeed, she comes into the world, and what is worse, prone to rude and wild passions. But, she soon learns to know herself, and to make the use pre-ordained by the Creator of the Universe, for such inestimable gifts. Experience and culture at length bring her to a full knowledge of her endowments, and of the boundless gratitude she owes to him from whom they have been derived. And here I feel myself on firm ground. Diogenes Laertius says, Plato left absolute certainty to the Gods, and to the children of the Gods, and contented himself with humble

probability. Pythagoras did the same before him. "For God alone," says he, "knows every thing, and man merely conjectures." They both were right: yet I confess I feel no propensity to scepticism, much less to withhold the declaration of my belief, when what appears to me in certainty, is before me; and nothing in my judgment can be more certain, than that man comes into being with an intellectual, as well as a corporeal capacity.

LETTER LVI.

MEN resign their judgment to the authority of the tyrant Custom, and embrace things implicitly, as they are established by general consent. We neither turn to the right nor to the left, to deliberate or investigate. We account that most clear, which is most confidently said. Custom, in short, is, in almost every instance, so overbearing, as to outface reason, and the ablest men are often its most determined idolaters.

All men, it is true, with respect to first principles, are as much philosophers as Plato, Des Cartes, or Locke. In an affair of manifest experience, and of a sentiment immediately obvious to the first motions of the soul, and common to all mankind, all men in this respect are philosophers. So that a philosopher, when nature and common sense are in question, is only as one opposed to a million of other philosophers. But, in matters acquired by reason and argu-

ment, and where particular reflections, not made by every person, are required, here, indeed, he may deserve more credit than another.* And yet from what we have seen from some celebrated metaphysicians, we are not altogether warranted in yielding such supremacy. I may be obliged to acknowledge that which is false, for that which is true; but a sophism is not to be forced upon my understanding for a proof.

To damn a man for bad reasoning, is absurd. At the same time infallibility should not be too hastily admitted, for it unavoidably leads to error. The old, but opposite systems revived by Locke, and Berkley, have each had their admirers; but each have had their fall under the superior energy of common sense. Nor is it probable they will hereafter be very pertinaciously insisted upon. The junction of an immaterial with a material substance, is the belief of the world at large: and therefore all matter, or all spirit, are doctrines that will not be credited, at least by the majority of mankind.

Among researches, however, of this nature, the very singular though not novel idea has sprung up, that even *language* is not natural to man;

* Buffier.

man; that the faculty of speech is not the gift of nature to man, but, like many others, is acquired; and that in fact, man was at first an *innocuous frugivorous* animal, feeding, as monkeys, upon the fruits and the vegetables of the earth, until at last he became *carnivorous*, and then felt delight in slaughter and blood. *

It is somewhat severe upon poor human nature, that we are obliged to support the existence of her undoubted prerogatives, by reference and comparison to those of other animals, whose rank is evidently inferior in the orders of the creation. Thus, innate reason would not be allowed us, unless it bordered so closely upon innate instinct. Nor would speech be admitted to be natural to man, were it not demonstrable, that various other creatures have the intuitive faculty of conveying their sentiments to each other, through the medium of sound. Democritus, who laughed at all things, held, that men had learnt most of their arts from dumb creatures: as that the spider taught us to weave, the swallow to build, the nightingale to sing, and different quadrupeds to comprehend the art of physic. "What discipline," says he, "is there not to be learnt from bees? What prudence from ants? and what

* Monboddo.

what clear discrimination from cats, dogs, emmets, and mice?"

But is it not too degrading, is it not almost ingratitude to the almighty Author of our nature, to reduce the first of his terrestrial beings to an inferior degree of created intellect? To believe that the understanding the most comprehensive, is the least informed? Or that man, who even dares to look up to God himself, and to scrutinize the phænomena of the universe, is yet thrown into existence with so miserable a portion of endowments, as to be under the necessity of learning from inferior animals the most common, if not instinctive exertions essentially useful to nourishment, to propagation, and to life? "Man," says Montaigne, "is the only outcast and forsaken creature upon earth; having nothing to cover or arm himself with, but what he despoils from others; whereas nature herself has clothed and fortified all other creatures with hair, wool, stings, horns, scales, feathers, talons, claws, teeth, &c. instructing them in every thing necessary for their preservation, as to swim, to run, to creep, to fly, &c. But, man can neither feed, speak, nor shift for himself, unless taught by others.

Man,

Man, in the savage and uncultivated state, is, I acknowledge, in the lowest and least improved condition of human nature; and in that which approaches nearest to the brute creation. But, I see no reason thence to conclude, that this is the *natural state* of man. The very reverse is evident. It is, I allow, the general point at which philosophers chuse to commence the history of their species. But, to suppose men to be out of their natural state, as soon as they begin to form plans of government, and to invent the useful and ornamental arts of life, is as irrational, as to suppose ants out of their natural state, when they store up their hoards for winter; or bees, when they construct combs for their honey.

We know nothing but from effects. The principles themselves, and their manner of operation, are totally unknown to us. Were we to judge only from the appearances of uncultivated man, we might be apt to embrace the opinion of Diodorus Siculus, that the first of our species lived in woods and caves, in a manner similar to beasts, and uttered only inarticulate sounds. But, it is not perhaps possible to form a judgment more contrary to fact. Does not the nature of all animals, beasts and birds, shew us, they

they have all of them a natural *untaught* language, not consisting of confused sounds, but altogether distinct, by an articulate difference, and highly intelligible to every one of the same species? If, therefore, the nature of things will allow us to suppose, that man was created as perfect in his kind, as other animals were in theirs, then the nature of things will oblige us to affirm, that the first of mankind had from nature an untaught language, intelligible to themselves, and suitable to the end of their creation.

In researches into the faculties of man, as in every other kind of research, the sublimest genius, and he who dives the deepest, will discover nothing but what existed before; nothing but what may be unequivocally traced in exemplars in nature; in short, nothing but what must incontestibly prove to us, we are not creators, but merely discoverers. In the review of this globe, and even in the more familiar, as well as in the more involved and complicated subjects, we evidently appear to have been imitators; to have commenced even what is called invention, by copying. Are we, therefore, as to language, to conclude, that something was not originally established? Though spiders taught us to fabricate our garments—though

birds

birds taught us to rear coverings to shelter us from the inclemency of the elements;—and though ants and bees taught us to gather into society, and to be industrious and provident; yet, which among all the classes of animated beings could have instructed us in speech, or in the wonderful power of the combination of words? The elephant, though a sagacious animal, does not understand logic. The canine race, though they may be mechanically taught their letters, cannot be made grammarians!

Animals, it is certain, have some senses of exquisite acuteness; but, it is worthy of remark, that the degree of excellence in the senses, follows not the same order in the brute, as in the human species. The sense most analogous to thinking, is that of touch; and this sense is more perfect in man than in other animals. The sense of smelling, that universal organ, which perceives objects not only where they are, but where they have been, is most analogous to instinct and appetite; and the brute enjoys it in a superior degree. Hence man should excel in knowledge, and the brute in appetite. In man, the first sense for excellence is touching, and smelling is the last. In the brute, the sense of smelling is the first, and that of touching is the

the last. Thus we see the invincible aversion which brutes have to certain aliments, and their natural appetite for such as correspond to their constitutions. But man, if he were not instructed, would eat the fruit of the *mancinella* like an apple, and helmock like asparagus.*

In a rude and savage state, with a precarious subsistence, exposed to the vicissitudes of the seasons, and the fury of wild beasts, man is, indeed, an object of pity. Ignorant of architecture, of agriculture, of commerce, and of all the numerous arts which depend upon the mechanic powers, he exists in the desart, comfortless and unsocial, little superior in enjoyment to the lion and tyger, but much their inferior in strength and in safety. Notwithstanding this, such animals, though trained, are destitute of those divine attributes, thought and reflection. They are, indeed, conscious of their present existence; but they have no knowledge of that existence which is past. They have sensations, but they want the faculty of comparing them, or of forming any connected series of ideas. They are capable of pleasure and of pain, but, they have no knowledge of good or evil, however they may feel the distinction.

I acknow-

* Buffon.

I acknowledge the absurdity of the doctrine, that inferior animals are merely automatons, or that they are altogether material; while at the same time they are contradictorily, I think, allowed sensations. Matter cannot have intellectual perception. It does not appear that God has ushered them into the world simple machines. Other bodies in nature continue attached to the spot where they took their existence; they have nothing to search after, they have nothing to fly from. The heat of the earth is sufficient to transmit, through their parts, the juices which are allotted to nourish them. They have apparently no organ to judge which is the most suitable spot; they do not select and chuse; they *vegetate*. But animals watch over their own preservation; they move at will, they seize what is proper for them; and throw away and reject that which is otherwise. Their senses are even capable of improvement. Art and habit, through the aid of man, bestow on them uncommon perfection. For instance, birds can be instructed to sing, and to repeat words; and no one can deny, that the ardour of the dog for the chace, is to be increased.

The nature of brutes, however, cannot be improved to any what we call *rational* purpose.

Nor, though they can be brought to the imitation of sound, and even to that of articulation, can they ever be made to comprehend the sense, or to have the least conception of the complex ideas, which the words they pronounce excite in their instructors. In their attachments, it is true, and in their tractableness and docility, they shew an intellectual power of selection; and a memory, which keeps them to the prescribed limits of their duty. Moreover, though man, in his enlightened state, and when assisted by wisdom, has an universal knowledge on account of his universal wants; yet there are some instances, in which the instinctive, or half-reasoning faculties of brutes, appear even superior to the sublimest acquirements of mankind. While the academies of Europe propose alluring rewards for the discovery of the longitude, do not birds of passage traverse the boundless ocean, certain of their track, and innately ascertained of their latitude and longitude? In their annual emigrations, what progress do they not make over seas and over kingdoms! How miraculously do they not support themselves in order and discipline, through such a tedious and unbeaten route!

And this faculty is general, as are all the faculties of birds and beasts. Each distinct tribe has

has its peculiar and predominant feature. On every individual, is the same instinctive ability imprinted. In China, the swallow builds as in England. In Persia, the silk-worm labours as in Italy. Animals can even speak and understand each other; and their language has a simplicity, which is wanting to ours. Each species has an uniform idiom, always the same, in all ages, and in all countries of the world. Whereas ours, we know, is not only distinct for each people, but, each distinction is continually fluctuating. Nightingales and Canary birds sing (or speak, which is the same thing) precisely in the same terms their ancestors did before the deluge. Not that I will presume to say, the serpent had in former days a long conversation with Eve; or that Balaam's ass spoke to his master; much less repeat the fable of Achilles's horses. For, the one being allegorical, and the other imaginary, prove nothing in the order of nature. * But observe the dove with his companion. What a language of love, tenderness, and expression! See the sparrow how he scolds his mate, when she plays the coquet. Look at the morning herald, the cock, how he struts before his seraglio, and loudly bids defiance to his rivals who are abroad. Look at the little wren, how he knows his wife's

* Lang. de Bêtes,

voice, when she calls upon him: how he ransacks the country for her at her desire, while she watches her nest: how he, in all the endearments of domestic familiarity, holds converse with her from a neighbouring bough, while she incubates her eggs. Is not this a positive and an intelligible articulation of sounds? It is not, indeed, branched out and complicated, as our's is. But yet, it is not without its advantages. The little chatterers, it is true, cannot abundantly vary their strains, but yet they can speak to the purpose, and always with a knowledge of their subject. What is more, they must always speak truth, and, even in love, be honest.

Let us, however, still look a little farther. We speak every day to animals, and they understand us The shepherds are understood by the sheep; the drivers are understood by the oxen. How quick is the comprehension of the elephant; how well does the hunter understand the language of his rider. When I call my dog, he runs to me. When I flatter him, he caresses me. When I menace him, he flies me. When I command him, he obeys me. Is not here every unequivocal sign of apprehension; and am I not consequently warranted in concluding, that this animal is capable of understanding certain combinations

binations of sound? Many animals are made to live in society, and others to live in at least a state of domestic agreement, for instance, male with female, and with their little ones as a family, until the offspring shall be reared and educated. Now, of what benefit can we conceive this to be, unless there be one common and certain mode of communication, which shall be clearly understood by each member of the community? If they be not allowed to understand each other, how can it be supposed their society can exist? Observe the beavers: these animals, to preserve themselves in security and concealment, lodge in cabins of earth, which they construct upon piles on the banks of lakes, with most admirable dexterity. These cabins they build in federal concert. Thirty and forty engage in the same enterprize. They pitch upon the ground. Some go to the woods, and fell down trees; others get the timber home. Some are masons, others are carpenters. Can a plan so evidently determined upon with deliberation, and so accurately followed up and executed, be supposed to have proceeded from animals who could not speak, and who could not communicate their thoughts through the medium of sound? Remember what is said of the Tower of Babel. The means employed by God to destroy that senseless project,

was to give them a confusion of tongues. The workmen having at once forgotten the common language which they spoke before, and not being able to understand one another, could no longer act in concert, and consequently were obliged to abandon their labours. I do not here, however, pretend to say, that the different languages of animals are to be understood, or that dictionaries of them are to be compiled; much less that we should ever be able to discuss, with their learned doctors, theses in morals or in philosophy.

"In the happy commerce of the first of the human race," says Rousseau, "no more necessity existed for a combination of words, than there is at this moment among monkies or crows. Inarticulate sounds, gesticulations, together with an innate propensity to the imitation of other beings, were all that were possessed by the children of humanity. Man, in a state of nature, had no need of language, nor even of the faculty of reason. Savage and stupid, he had nothing but an animal existence to preserve; an existence that was yet more happy than that which results from civilization and instruction. The *ouran-outang* was man, in his highest felicity. When we came from the hand

of

of nature, we were all well, we were all good and happy; for we were all stupid and savage as the bear. In process of time came civilization, and with civilization came misery, with arts and sciences, and a certain and unequivocal damnation to mankind. "Not so" however, altogether," says Boulanger: "we are indeed wretched, but it is not from our emancipation from dulness and brutality, that we are so; it is because terror, at the submersion of the earth, instituted religion; and from religion has arisen envy, hatred, malice, and all uncharitableness." These two men, thus, if we believe their own expressions, dipped deeply in the book of nature; the book which never leads astray. But, Gebelin dipped in the book of nature also, and he saw, that both of them had erred from the ways of truth, and were deceived. *Damnant quod non intelligunt* * "We are indeed born stupid and miserable," says Gebelin," "and that from necessity, in the great order of things; but we have a proneness to perfectibility: we have an instinct capable of improvement; and in this respect we certainly are different from brutes." Now, what is the real doctrine of these three philosophers? Rousseau teaches, that misery comes from the cultivation of the understanding. Boulanger

* Quintilian.

teaches, that misery comes from the cultivation of religion; and Gebelin, that without the cultivation of both one and the other, we are inevitably wretched.

How such inferences are to be deduced from the general appearance and order of things, we shall not stop to enquire at present. "I am persuaded," says Monboddo, * that the beaver did from experience and observation, (the old teaching the young) learn the architecture of his dike and his hut, as we have learned our architecture and other arts." Other writers maintain, that instinct in beasts is preferable to reason in man. How completely does it direct the bird in her daily labours, till her nest is completed! Who acquainted her that she was to lay any eggs; that a nest was absolutely necessary to preserve them from falling, and to bring them to perfection by a genial heat; that such heat would not meet in one center, were her nest too extensive; and that all her young would not have house room, were it more narrow and contracted? By what means is she informed of its due proportion and extent, and the exact number of her future progeny? Who has regulated her calendar, that she may calculate her time aright, and

* Orig. and Prog. of Lang.

and not lay her eggs till her nest is finished and ready for the reception of them? What wonderful marks of contrivance and art in these little habitations, and yet they have no instruments but their bills! Again, what care has this active, wandering, restless little creature to her eggs! Bidding adieu to all manner of pleasure, she never stirs for days successively from her brood; and in short, carries her parental tenderness and affection for them so far, as to neglect her very food. Observe the conduct of a mother of this kind with a brood of chickens around her, and you will find her a new creature. Her tenderness and affection for them alter her very nature, and correct her imperfections! Before, she was voracious and insatiable: now she is abstemious and frugal. If she casts her eyes on a grain of corn, a crumb of bread, or any thing, though ever so inconsiderable, that is capable of division,—she will not touch the least portion of it; she gives her numerous train immediate notice of her success by a peculiar call, which they all understand. They flock in an instant around her, and the whole treasure is appropriated to their service. Though by nature timid, and apt to fly from the least animal, yet when marching at the head of her little troop, she is a heroine, is fearless of danger, and will fly in the

face of the fiercest mastiff. Again, let me ask what is it informs the young birds of passage, that it is requisite to abandon their native land, and to travel into a foreign country? Who is it that appoints the particular bird to take the charge upon him of assembling their grand council, and of fixing the day of their departure? Have they any charts to direct them in their course? Have they any knowledge of what islands lie in the way, where they may rest and refresh themselves? Have they any compass to be their infallible guide to the coast proposed, without having their measures disconcerted, either by accidental rains, adverse winds, or long, dark, and dismal nights?*

This is all marvellous. But, what is it? Is it reason, or is it instinct? Whether the one or the other, the effects seem purely the same. Instinct, indeed, is a convenient word; but, as it seems without a distinct meaning, what is instinct? A sentiment not reflected upon, the principle of which is unknown; a blind desire; an unweighed taste; a mechanical movement of soul which forcibly impels. This is all well for the schools; but, were I to give it a name, I certainly would not distinguish it from the faculty

* Spect. de la Nat.

faculty of reason: of reason, indeed, limited, and not boundless as the reason of man. To be convinced of truth, we must first know error. *Primus autem sapientiæ gradus est, falsa intelligere.** I would, therefore, humbly ask those who would level every thing to the standard of their own prejudices and caprice, whether the God of Nature has, from the beginning, given to all his other works, except man, that degree of perfection which is essential to them? And whether it is becoming in man to charge his maker with having neglected him, while he lavished distinguished favours on the inferior orders of the creation? The bird flies through the air, the fish swims in the water, the quadruped bounds over the earth, the tree brings forth its fruit; the sun, the moon, the planets, in a word, the universe at large, moves according to the prescribed and unerring order of creation; and shall man alone be said to have been doomed to an unmeaning silence, and to a mournful stupidity?

God has dealt with the human, as with every other race, and has given it its mode of existence, and its dispositions and manners of life. Man's mixed disposition to friendship or enmity, his reason, his use of language and articulate

* Lactantius.

culate sounds, like the shape and erect position of his body, are to be considered as so many attributes of his nature: they are to be retained in his description, as the wing and the paw are in that of the eagle and the lion; and as different degrees of fierceness, vigilance, timidity, or speed, have a place in the natural history of different animals.* "There must have been society," says Monboddo, "long before language was invented, and not only that, but other arts must have been invented before this, the most difficult one was found out. Not," but that I admit, says he, "there can be no language without ideas, and that there can be no ideas, at least in the human mind, without abstraction: for men could never have given a name to that of which they had no idea; and if they had not a separate idea of any thing, as distinguished from other things, they could not have given it a separate name." But, how has this notable discovery been made? If there had been a period in the history of mankind, when language had not been known, how came the knowledge of that state of degradation to have been handed down to us? The fact of the want of language, could only have been made known to posterity, by means of language. Unarticulated or unwritten intellectual

* Ferguson.

intellectual ideas, can never flow down through a succession of ages. Can universal intelligence, and universal dumbness be given a co-existence in men, and in no other race whatsoever? If mankind, moreover, had not a *natural* language, could they have ever invented an artificial one by their reason and ingenuity? All artificial language supposes some compact or agreement, to affix a certain meaning to certain signs. There must therefore have been compacts or agreements before the use of artificial signs; and these compacts or agreements could not have been without signs and without language. Hence the widest necessity of a natural language, before any artificial language can be invented.* Can we ask, let me repeat it, was the eye contrived without skill in optics, or the ear without a knowledge of sounds?†

Philosophers have said, there is a greater difference between men than there is between men and beasts. Granted, but with very many and very weighty exceptions. In man, as well as other animals, we find the same material organized body, the same senses, the same flesh and blood, and the same motion. But, these analogies are *external*. Do the internal ones as accurately

* Reid. † Newton,

curately agree? The most stupid man manages the most alert and sagacious animal. He makes it subservient to his purpose; and this by means of a reason, which enables him to project, and to act in a systematic manner. The strongest and most sagacious animals, cannot reduce their inferior tribes to a state of servitude. They indeed devour them. Among animals there is no mark of *subordination*. The nature of man, therefore, is not only superior, but, likewise, of a different kind. Animals neither invent, nor improve upon any thing they have found invented. If they were endowed with the power of progressive perfection, the present race of beavers would build their houses with more art and solidity than their progenitors. With us, much time, reflection, and patience, are necessary, before the meanest of our arts can be brought to maturity. Every other species of animals performs the very same work, and in the very same way.*

It is alleged, there is no difference between man and beast, but in the external form. "Every one knows," says Mirabaud, "the embarrassment which animals have given to the partizans of spirituality. In effect, in allowing them a soul, they feared to raise them to a level with

* Buffon.

with human nature; and, on the other hand, in refusing them a soul, they authorized their adversaries equally to deny a soul to man, which would level him with the brute."* But, this allegation does not answer the boldness with which it is advanced. Man, we see clearly, is at least an *inventor* upon earth, for he fills it with works which God never placed on it. Castors build huts, foxes dig holes, and birds make nests; no more must be required of them. An invincible and uniform impression constantly brings them to that point; and, without complex reasoning, still inclines them to produce works which never vary. If they did reason as man, their works would be various as their rational operations. But man, when he received the impression of an activity that makes him hate inaction, was not confined to one single method or manner of employing himself. He was given over to his own unlimited reasoning and counsel. He searches, he tries, he deliberates, he combines; he makes new observations, new projects, and new works. We see coming from his head and hands, things of which there was no model in nature: † a mill, a gun, a watch, a poem, a code of legislation, and a system of philosophy. That we can descend to a lower state

* Syst. de la Nat. † Spect. de la Nat.

state of human nature, is indeed true: we can descend to the wretched native of the comfortless shores of Terra del Fuego. But, cannot we again rise, and contemplate reason with the assistance of learning and science, advancing through the various changes of the human capacity, one soaring above the other, till in a Bacon or a Newton, it attains the summit of sublunary perfection?

Right reason, from the beginning, has been the rule of human actions. Man was never worse than the brute, and in a state of incommunicable mental incapacity. Nor can any thing be better founded, or more conclusive, than the opininion, that the Author of all Nature, having given to his different creatures different natures, according to the different purposes for which they were designed in the scheme of his providence, and every one of these natures including its own peculiar law, whether that of instinct or that of reason, the most rational of his human creatures hath irradiated the earth from time to time, conformably to his almighty preordination. The first of our species were thus certainly made rational, and endued with knowledge by the immediate power of the Deity. All the philosophers that

the world ever produced, will never be able to account for the origination of mankind otherwise. And in the same manner, it is to be presumed, they were gifted with the primeval use of language. For if the frame of the human body cannot give the soul the power of moving itself, without the immediate help of God, much less can it endue the soul with the power of reasoning. The artifices of the bee, and the ant, are ascribed to the wisdom of nature; those of the human intellect, to an incomprehensible growth. The *rasa tabula* will not allow us to have mental ideas. The fashionable modern philosophy will not allow us the faculty of speech. Thus, man, who prides himself in being the lord of the creation, comes into the world in a worse state than the hedge-hog, without either ideas or language. The individual in every age, it is said, has the same race to run from infancy to manhood; and every infant, or every ignorant person, now, is a model of what man was in his original state. He enters on his career with the advantages indeed peculiar to his age; but, his natural talent is precisely the same. This may be admitted: but, hear Buffon. "The beavers," says he, "afford perhaps the only subsisting monument of the *ancient intelligence* of brutes; for as man has

risen *above* a state of nature, so the other animals have sunk below that standard. To break a branch, and to make a staff of it; to build a hut, and to cover it with leaves for shelter; to collect hay or moss, and to make a bed of these materials, are operations common to the animal and to the savage. The beavers build huts, the monkies carry staves, and several other animals make commodious and neat houses, which are impenetrable to water. To sharpen a stone by friction, and make a hatchet of it, to use this hatchet for cutting or peeling the bark off trees, for pointing arrows, for hollowing a vessel, or for slaying an animal in order to clothe themselves with its skin, to make bow-strings of its sinews, to fix the sinews to a hard thorn or bone, and to use them for needles and thread,—these are not comparable to what is observed in the beaver. The operations of these animals are the fruits of wisdom and society. Their houses they build upon piles on the margin of the water, with two openings, the one to the land, the other to the water. Some are from eight to ten feet in diameter, of three and four stories, of two feet in thickness, and neatly plastered both within and without. Each cabin has its magazine of provisions. The village of these cabins often consists of twenty and five and twenty, and each

cabin has from two to thirty inhabitants. In case of apprehension from inundations, a bank is often raised, sometimes not less than an hundred feet long, and twelve in breadth at the base. The months of July and August they employ in the construction of their tenements. In September they collect their provisions of bark and wood; afterwards they enjoy the fruits of their labour, and taste the sweets of domestic happiness. They pass together the autumn and the winter. About the end of winter the females bring forth, and are then left by the males, who retire to the country to enjoy the pleasures and the fruits of the spring. They return occasionally to their cabins, but dwell there no more. The mothers continue in the cabins, and are occupied in nursing, protecting, and rearing their young, who, at the end of a few weeks, are in a condition to follow their dams. The females then make, in their turns, excursions into the country. They assemble not again till autumn, unless their banks or cabins be overturned by inundations; for in such event they suddenly collect their forces, in order to repair the breaches which have been made.*

Live the Hottentots, think you, in so comfortable and so snug a manner as this? It is

 doubted

* Buffon.

doubted whether many parts of Europe were in a better degree of civilization eighteen centuries ago. It may, notwithstanding, be remarked, that however extraordinary this picture, it is neither singular, as relative to human inferiority, nor entirely of modern fabrication. Many of the ancients, I will not say the wisest, ascribed to brutes an understanding, and a degree of reason of the same nature, but more or less, indeed, differing in degree from that of man. Hence, the elephant, they conceived a miracle; they even superadded to intellectual powers moral virtues. *Se abluunt, et purificant, dein adorant solem et lunam. Cadavera sui generis sepeliunt. Lamentant, ramos et pulverem injiciunt supra cadaver. Sagittas extrahunt chirurgi periti. Elephas est animal proximum humanis sensibus.* Thus Pliny, Ælian, Solinus, Plutarch, and others: in a word, they considered the elephant as a miracle of intelligence, at the same time that they considered him as a monster of matter.

The Sceptics, according to Sextus Empiricus, placed brutes on a level with man; and Pythagoras, and Plato, attributed any little inferiority that might be discerned in them, only to the want of proper and sufficient bodily organs. But, to pass by the ancients; their opinion

nion has lately been supported with considerable subtilty by Helvetius. Cudworth, on the other hand, has endeavoured to explain what he calls the instinct of animals, by means of a certain plastic nature, an intermediate being, existing between God and the universe; by which, under the direction of the Deity, the bodies and souls of men and animals, are excited to the production of certain ends, respecting their well being and preservation, without any knowledge, however, of the means, or any sentiment, appetite, or volition whatever, concurring to the production of the effect. This strange and mysterious system was again different from that of Des Cartes, who thought that all the actions of brute animals might be explained by the simple laws of mechanism. By Leibnitz, brutes were allowed to have a soul, and to be possessed of life and sensibility; but, a soul that had no influence in producing or directing the motions of the body, which, on its part, was as much a machine, as that of Des Cartes. The school of Buffon considered brutes, with Des Cartes, as merely corporeal machines, without a soul, understanding, &c. They differed, however, from that philosopher, in granting them the faculty of perceiving and distinguishing between pleasure and pain, together with a strong inclination to the former,

and aversion to the latter. Other philosophers explained the actions of brute animals, by mere corporeal feeling, without any assistance of the mind. Among these, Mylius is of opinion, that pain alone produces many of those actions which we attribute to design. He supposes that the caterpillar, for instance, at the time of its metamorphosis, labours under a fit of the cholic, produced by the superabundance of that glutinous liquor, which afterwards forms its envelope, or case, and which it twists round its body, drawing it into threads in a variety of directions, in consequence of the repeated contorsions caused by the pain it suffers during the time of its exudations.

Yet, however ludicrous and inconclusive the various opinions which have been hazarded on this subject, it is hard, that the only animal upon earth, that is capable of improving knowledge, or instinct, if you please, by the comparison of objects, and the constant employment of the intellectual faculty, is, in his original state, placed on the most degrading and the lowest step of stupefaction. The operations of animals are performed evidently *previous* to any experience whatever. The spider forms its web, and the lion-pismire digs its little pit, before the former has yet tasted a fly,

fly, or the latter an ant; or even before they know, or can have been informed that such insects exist. The caterpillar, at the proper season, weaves the case for its approaching metamorphosis into an aurelia, without having had any experience of its own, or having received any light or instructions, either from the example or the precepts of other caterpillars or butterflies. Further, scarcely has the young bee completed its metamorphosis from the crysalis state, and expanded and dried its wings, but it sallies forth *alone* from the hive, alights upon the proper flowers, extracts from them the proper juice, collects the farina, kneads it into a little pellet, and deposits it in the proper receptacles in its feet, returns back to the hive, and delivers up the honey and wax which it has collected and manufactured. But yet, although all this is wonderful and mysterious, the discriminative energy of reason, such as that of man, is in no instance to be traced. If this faculty, or even a moderate portion of it, were the guide which directs animals in their operations, they never would exhibit such instances of ignorance, as we every day observe. A hen will sit upon bits of chalk, and turn them with the same assiduity she does her eggs: she will hatch the eggs of a duck, and attend the young ones with equal care, though

so different in figure, in voice, in manners, and particularly in their propensity to *dive*, as soon as they are hatched, into an element so different from her own. Do not these instances then strongly indicate, that though animals may have a certain degree of knowledge, and a certain combination of ideas, they ought not to be elevated to, much less elevated above, the level of the mental powers of man? Certain *innate* and determinate ideas and inclinations, they evidently have had imprinted in them by the Author of Nature, *à priori*. But, the knowledge of brutes, which is the knowledge of the present moment, cannot surely be compared to the wisdom of man, which is the accumulated wisdom of ages.

Attend to several other striking points of difference. Man is the sole being, who has the disposal and management of *fire*, which is the principle of life: he is also the sole being who has the cultivation and management of agriculture, which is the support of it. All frugiferous animals have need of agriculture as well as man, but none of them have been endued with the sense, or the manner of prosecuting it. This art, so simple that the simplest man is capable of it, is yet so sublime, as to have escaped the most enlightened animals, from the very origin

of

of the world. Observe the dog, who, in intelligence, seems to approach towards the human capacity, who is every day witness to the effects of fire, who is accustomed in our kitchens to live on the meat that is dressed; yet you shall find him so absolutely unacquainted with the use of fire, that give him raw flesh and coals, and he never will manifest the least propensity to dress his dinner.*

* Saint Pierre.

LET-

LETTER LVII.

"AS language is among the first arts invented by man, so it is among the last lost."* I rejoice at this concession, though I very fairly confess, I cannot comprehend, how a man, in the eighteenth century, can possibly be acquainted with what was at the begninning of the world, or what may be at its close. But, would you make me believe, you will say, that astronomy, geometry, philosophy, and music, grew up spontaneously, without care or cultivation? I am far from advancing any such thing. Neither do I presume that language has, in every period of its being, had the like copiousness, the like purity, the like artificial structure, and the like combination. All I contend for, is, that language is not necessarily the work of man. Languages have been formed, and languages have been improved; for every age, in some corner of the world or other, has seen philosophers and grammarians. But, this does not imply an original want of the faculty of speech. Does it not strongly imply the contrary?

* Monboddo.

contrary? Capacity, I know, we are allowed to have received from nature. "Thus," says Monboddo," "a man, when he is born, has from nature the capacity of being a musician; he afterwards forms the habit, and acquires the faculty; and then he actually performs when he thinks proper." Thus has it been with language. Language undoubtedly has been altered and enlarged. But, I cannot bring myself to imagine, that at the beginning, Providence would have dealt harder with man than with any other creature. The most ancient languages we have, the Sanscrit and the Hebrew, I will allow, to have been artificially and regularly improved upon, for they bear evident marks of a progressive construction. But, these were modelled after *pre-existing languages*. The world did not begin with the Hindoos or the Jews, any more than it did with the Greeks and the Romans. Philologers lived before the periods of which we have either record or tradition. Adam had the faculty of speech. The first glimmer from the dark days of antiquity of every nation upon earth, exhibits speech in the respective first fathers of mankind, and more particularly in the traditionary divinities by whom they were enlightened.

The

The different classifications given to man, is perfectly astonishing. By this writer, we are degraded to the brute; by that we are made a fish; by a third we are called a vegetable. From the scaliness of his skin, Telliamed, very physically, concluded his ancestors were either whales or porpoises. Lametrie, in his body, arms, and legs, found a tree. "*Les poumons sont nos feuilles*," says he, "*si les fleurs, ont leurs feuilles ou pétales, nous pouvons regarder nos bras & nos jambes comme de pareilles parties.*" "I have perceived," says Robinet, "in our forests, and in our gardens, plants and trees that have partaken of our sensations, if not of our understandings." Their sensibility is well known. Is it not preposterous, therefore, to refuse them the gifts of thought and of knowledge analogous to their sensations? For what reason is it we conclude the metal and the mineral to be sordid matter, incapable of action or of sensibility? Does not the magnet distinguish the particles of iron it attracts, in virtue of its proper and of its distinct affection? Is the flint ignorant of the spark you mean to draw from the striking it against the steel? Have we any effect so marked as the touchstone on metallic substances? Why then do we blush to acknowledge mind in the rose, in the pink, in tin, and in lead, and, in short, in all minerals and vegetables?

vegetables? The philosopher, with his boasted powers, is not more wonderful than the common fire-stone, in the brilliancy it emits. That which gives, is superior to that which receives. The faculty of giving light is superior to that of perceiving light.

This universal pre-science and animation, how bewitching! How charming to behold the delicious intellectual sensations of artichokes and cauliflowers; the pleasures and delights of cabbages and lettuces; the ardent desires and affections of melons and cucumbers; how amusing to figure to one's self a tulip running after the gardener with its eyes, as a dog after its master; to distinguish the generic qualities of stones and of metals; to be convinced that the Venus de Medicis has a soul similar to the sculptor who formed her; and that the glowing pictures of Titian are all animated, and conscious of admiration. We have already, however, had so many ridiculous systems, that we may be excused, if we overlook others equally as absurd.

The noble faculty of mind, of which we have already spoken, is doubtless, in some degree, granted to some other parts of the creation, as well as to that of the human species. It is that which

which directs all animal action, whether instigated by internal or by external causes. It is that which rears and imbibes ideas, and which gives them a future, as well as a present efficacy. The general laws of matter are immediately influenced by a spiritual immaterial cause, without which power or energy, no mental action could be induced. Animals, we see, are possessed of this intellectual inhabitant. Even vegetables are irritable, and exhibit extraordinary instances of sensation. The powers of the human mind lie concealed at our birth, and remain, as it were, folded up, till time and opportunity display them and bring them into action. In this state of infancy, it is said, there is little difference between us and other animals: and if there be any, the advantage is said to be on the side of the brute; for his body is commonly then more vigorous and more active. Our subsequent superiority, it is also contended, is *adventitious*, and from *acquired habit:* nor even is it quite clear, that we are from nature entitled to any superiority. There is no denying, as I have often said, that brutes have the capacity of acquiring the habit of not only forming some general notions, but, of comparing them together, that is, of partial reasoning. Porphyry, the greatest philosopher and the best writer of his age, relates that crows, and magpies,

and parrots, and another bird which he calls εριθακος, were taught in his time, not only to imitate human speech, but to attend to what was told them, and to remember it. He even maintains, that all animals who have sense and memory, are capable of intellectual reason: and this, he says, is not only his opinion, but that of the Pythagoreans, as well as that of Plato, Aristotle, Empedocles, and Democritus.* One thing, indeed, we must allow cannot be denied, that the natures of animals may be much improved by use and instruction, and that they may be taught to exert their abilities in a wonderful manner, and far exceeding their apparent natural power of instinct. †

Man begins instinctively, or with an innate impulsion. From sense, memory, imagination, reason, and opinion, which join in succession to each other, comes the last and best faculty of the human mind, scientific and discriminative knowledge. "This is the scale of being," says Monboddo, "rising by proper gradations, from mere matter and sense, to intellect, through the medium of memory, imagination, and opinion. It is then that man is, what the ancients call him, an *opinion-making animal*, Ζωον δοξοποιητικον." ‡

With

* Porphyr. de Abstin. † Monboddo. ‡ Polybius.

With these faculties, we may safely venture to pronounce, mankind are universally endued. All men are so framed by God, that they may perceive the same sun and the same objects by opening their eyes, and apprehend the same truth, by making use of the same reason. This proves that there is a *permanent stock* of ideas in the human race, that supplies them with truth, with knowledge, and with sentiments of general utility; and that the human mind can, and will perceive, judge, reason, and arrive at the very same principles of sciences and conduct in every corner of the earth. I do not say, indeed, that all men are born alike. The contrary is notorious. Some are born with minds fraught with the seeds of wisdom and genius, others with those of idiotism and madness: as some are born with beautiful and healthy bodies, and others with frames distorted and filled with the most deplorable diseases. The ordination of Providence, however, in mental powers, is hid from man. Whatever may be the rule, that rule is beyond our comprehension. Whatever wisdom constitutionally may be, it is to us as a seedless plant; it may be reared when it appears, but it cannot be voluntarily produced. It is not to be propagated in hereditary succession.

The

"The spheres of men's understanding," says Burnet, "are as different as prospects are upon the globe. Some stand upon a rock or a mountain, and see far around them; others are in a hollow or a cave, and have no prospect at all. Some consider nothing but what is present to their senses; others extend their thoughts both to what is past, and to what is to come.* And thus, more precisely speaking, is it with regard to other animals. The unbounded discrimination, the abstraction of the human intellect, is where the road parts between man and brute. Man is able to *generalize*, and consequently able to *compare*. This gives the exclusive strength to the intellect, and to the reasoning faculties of the human mind. Brutes, I know, make comparisons also, but then it is only when the sense is excited by the presence of the object. They are not capable of mental abstractions, or of science.†

The power of memory, recollection, and remembrance, is wonderful in man. It is not so in brutes. In our memory, how many different words, how many adventures, how many volumes, how many languages, what a field of history and chronology! What a receptacle of

* Theory of the Earth. † Monboddo.

sensations and ideas, where so many acquire ments are deposited; where events swallowed up by time, *and never to return*, are preserved from the eternal night of oblivion; where times, which are no more, enjoy a kind of perpetuity! This is the mirror of past sensations, ideas, and sentiments; as sensibility is the mirror of sensations and sentiments, which are present. Nor is this faculty of memory to be conceived different from the faculties of the judgment and will. Both the one and the other are spiritual. For instance, it not unfrequently happens, that from disease we almost *forget* every thing, and that *recollection* afterwards returns by slow degrees. But, if the characters and impressions which *preserve* the image of objects in the soul, be of that material nature that they may be defaced, how is it, that when once rubbed out, they ever should return? Once blotted out from the *rasa tabula*, there should be an end of all sensations. Existence and non-existence cannot be predicated at the same time.

The images lodged, indeed, in the memory of man, often present themselves to his mind, without any fresh sensation, and so spontaneously, that the mind seems as passive in these secondary perceptions, as it was in receiving the first impression.

pression. Our simple ideas, and even our complex ideas, return reiteratedly of themselves, we know not why, nor how; uncalled by the mind, and often so as to disturb it in the pursuit of other ideas, to which these intruders are foreign. On the other hand, we are able at our will, and with design, to put a sort of force on memory, to seize, as it were, the end of some particular line, and to draw back into the mind a whole set of ideas, that seem to be strung to it, or linked one with the other. In general, when images, essences, ideas, notions, that existed in the mind are gone out of it, and have no longer any existence there, the mind is often able to will them into *existence again*, by an act of which we are conscious, but of which we know nothing more, than that the mind performs it.* Each mind, in fact, is a world within itself. It is peopled with nations, classes, and individuals. It is filled with friendships, enmities, indifferences. It is full of the past, the present, and the future; of the springs of health, and of the engines of disease. Here joy and grief, hope and fear, love and hatred, fluctuate and toss the sullen and the gay, the hero and the coward, the giant and the dwarf, the deformed and the beautiful, on ever restless waves. We find all

* Bolingbroke.

within us, that we find without: the number and character of our friends within, bear an exact resemblance to those that are external: the number and character of our enemies within, are just as many, as inveterate, as irreconcileable, as those without. The world that surrounds us, is the magic glass of the world within us.*

Neither beast, vegetable, nor fossil, can approach this woundrous microcosm, man. We are seen, indeed, to rise from a barbarous state to a state of extraordinary intellectual powers. All discoveries, both ancient and modern, and the domestic history or tradition of the most enlightened nations, represent the human savage, naked both in body and mind, and destitute of laws, of arts, of ideas, and almost of language. But this state, I hold not to have been our *original state*. We can recur to no nations that ever were in ignorance; but we can recur at the same time to *co-existing* nations that were in refinement. When can we trace an uncivilized society, that we cannot at the same time trace a civilized society? To go still farther; intellectual capacity seeems, I must maintain, the first born, and to have a claim or right to all the honours of primogeniture, for intellectual capacity

* Lavater.

city first found out the way of exploring ignorance, and afterwards of correcting it. From the abject condition of the savage state, however, man has been seen gradually to arise, to command other animals, to fertilize the earth, to traverse the ocean, and to measure the heavens. In the progress and improvement of his mental and corporeal faculties, he has been seen to have been irregular, and various; infinitely slow in the beginning, and increasing by degrees with redoubled velocity: ages of laborious ascent have been followed by moments of rapid decline; and thus the several climates of the globe have felt the vicissitudes of light and of darkness. *

"It is a beautiful and noble retrospect," says Rousseau, "to take a view of man, rising in a manner by his own efforts out of nothing, and dissipating, by the light of reason, that darkness with which he was by nature involved: to see him raise himself in imagination beyond his native sphere; penetrating the celestial regions, and like the sun, encompassing with giant strides, the vast extent of the universe: to behold him again descend into himself, a task still more noble and difficult! There to investigate his own nature and faculties, and thence to discover

* Gibbon.

the design of his creation. With this reason he has indeed conquered the universe; with this reason he has established an empire, which knows no limits." And shall we say this reason is artificial, and to be distinguished from nature? Art itself is natural to man. He is employed, from the first age of his being, in inventing and contriving. His emblem is not that of a stagnating pool, it is that of a stream, springing from a pure and an exhaustless source.

Man being from the beginning thus endowed with superior talents, I cannot but adhere firmly to the belief, that from his origin he has had language. What that language was, I know not. It most probably no longer exists; for language, as every thing else in this world, is fluctuating. Those which have been handed down to us, have probably been subsequent and progressive fabrications. The idea of tracing the origin and progress of language, may certainly whet ingenuity, but, I cannot call it philosophical. Moreover, where is the utility of such speculations? Did not Bishop Wilkins construct the outlines of an universal language, which were greatly approved, but which were never more heard of; and did not Psalmanassar, with equal ill success, absolutely frame one in London, as that which

which was in use among the people of the Island of Formosa, and which stood the test of critical examination? Neither can there be any more difficulty in picturing a people, coining their ideas into currency, and uttering them to each other, than there was in Locke's picturing a people without any ideas, and leaving them blocks, till they were taken possession of through the medium of the senses! But, is it really probable, that as all the vegetables, such as the vine and the olive, which are now cultivated and improved by art; and in like manner, the brute animals that are tamed, were at first wild; so likewise man himself was originally a wild savage animal, till he was tamed, and humanized by civility and arts? Who tamed him? or, are we submissively to acquiesce in the sentence pronounced against man, of his being, at his origin, the *ourang outang*, in whom the man is easily distinguishable, and whose mind is such as that of a man must be, uncultivated by arts and sciences, and living wild in the woods? *

The efforts of invention are only a continuation of natural propensities; for in what situation of the human race are the footsteps of art unknown? The highest refinements of political

* Monboddo.

and moral apprehension, are not more artificial in their kind, than the first operations of sentiment and reason. If we admit that man is susceptible of improvement, and has in himself a principle of progression, and a desire of perfection, is it not improper to say, he has quitted the state of his nature, when he has begun to proceed; or that he finds a station for which he was not intended, while, like other animals, he only follows the disposition, and employs the powers that Providence has given him? * The general perception of sense are not so appropriatedly our own, as the general conclusion of reason. Why should we then suppose, that a mere negation of all our virtues, and of all our talents, is a sufficient description of man in his original state? The tree which covers the field with its shade, was once a feeble plant in the nursery, and not to be distinguished from the weeds by which its early growth was restrained. But, had not this tree a parent, and did not that parent, in due season, push forth its fruit?

Every man, we are told, is the architect of his own ideas, and forms a little intellectual world in his own mind. This, in a high state of improvement, may in some respects be acknowledged,

* Ferguson.

knowledged. In the *fallen*, (not the natural state of mankind, as it is called) it evidently is not so. The translation or adoption of the ideas of others, is that alone, which cultivates the intellectual soil of a rude people. The revival of learning, for instance, in most countries, appears to have first owed its rise to translation. At unenlightened periods, the modes of original thinking are feeble, and the arts of original composition have not yet been studied. Men, therefore, are most usefully employed in importing the ideas of other languages. They thus naturalize the knowledge of more learned ages, and, as it were, imperceptibly by ingraftment, improve their own.* The elements or first principles of an art, indeed, are anterior to the art itself. But, the art, as a corresponding whole, is more frequently the result of accident than premeditation. How easily then may we fancy to ourselves, the fallen children of the human race in the ages of their progress, like scouts gone abroad on the discovery of fertile lands, having the world opened before them, and presented at every step with the appearances of novelty!

We are all apt to take that for a spontaneous produce of our minds, which we were early taught and

* Warton.

and long habituated to; and to call that a discovery, which was insensibly instilled into us, before we began to consider how notices and information are communicated to us, or to keep any registry in our memories, of the times when this or that addition to our fund of knowledge was made. But, when the matter is considered closely, we shall find the conclusions, though not the principles, of all we know, have been conveyed by instruction, either mediately or immediately. The reasoning faculty has never been in an universally torpid state among any communities of mankind. Thinking, we can even perceive in ourselves, is without rule, choice, or attention. Many of our judgments, we find irregular and incoherent; nor is there always a necessary connection between the subject and the attribute. But, this is peculiarly observed during sleep, when the senses are at rest: then the mind disports with different objects and forms, by an assemblage of thoughts and sensations, and by all the illusory means of a rambling fiction. In the derangement of the intellect, in madness, however, it is still more observable: for that which constitutes the difference between wisdom and madness, is solely *attention*, which always accompanies the former, but never the latter. We may think without attention, but we cannot reflect

flect without attention. The activity of the mind, therefore, certainly cannot be denied. Some actions follow our volitions, but they make scarcely a distinguishable part in the great series in which we are necessarily involved; and our temperament, the materials of judgment, and the impulses of passions and affections, depend upon circumstances that rise in a manner fortuitous, and to us inevitable. Nothing can, or ever could stop the activity of the soul, but being clogged with an ill-contrived system. Wherefore, as we cannot deny action, why should we deny perception and discriminative faculties to the human intellect?

"Nature never intended man," says Buffon, "for the contemplation of abstract subjects. To be occupied without relaxation in difficult studies, to lead a sedentary life, and to make the closet the center of our existence, is equally unnatural, as to pass our days in tumult and agitation, continually drawn along by the movements of thers, and obliged to keep a jealous and constrained watch over our own conduct, looks, and gestures. We are less fitted for thinking than for acting, for reasoning than enjoying. Our best gifts are those we receive from nature. She presents us with the useful and inexhaustible

tible enjoyments which arise from the air, the earth, the fields, and the fruits."—This is all specious, I confess, but is it true? Is it certain, that the mind, which has an incessant action, is not in the place allotted it when in contemplation? I readily allow that all men are not to be actuated by reasoning and philosophy, and that the human race might long since have had a period, had its preservation depended only on the reasonings of the individuals who compose it. But, this I am convinced of, that the rank and the sway which man universally bears, have resulted from the concurrence of his reason and his senses. I do not mean that sort of reason which would determine the age of the past existence of the world, from the saltness of the sea; and the age of that which is to come, from the wanderings in the pale of Christianity; nor that which would mathematically teach us to value the sum of good and evil, by the comparison of the intensity of pleasure and of pain, with their respective durations.

Man, in a savage state, is doubtless more fitted for action than for thinking. But, then, when we consider the immense labours of mankind, which have originated in their reason; the many sciences brought to perfection, the arts invented, the

the powers employed, the deeps filled up, the mountains levelled, the rocks torn asunder, the rivers made navigable, the tracts of land cleared, lakes emptied, marshes dried, enormous structures erected on land, and the floating castles that cover the sea;* how loudly do these speak in favour of the human intellect! Regard the plaything which hangs about the infant's waist: it is composed of a crystal cut from the rocks of Madagascar, and of silver which has been dug out of the mines of Peru. The bird that he plays with, came from the extremity of Asia; and the feathers in his cap were torn from the ostrich of Africa. Every part of the globe lays its contributions at the feet of man. The earth, and all it possesses, is visibly submitted to his intellectual combinations, and subsequently to his corporeal industry. Systematic abstract contemplation does not, indeed, affect this. No good ever resulted from learned pageantry, empty speculations, and pretended profundities. But, the geometrician, who never ploughed a field in his life, teaches the farmer how to ascertain the limits of it. The botanist, who never handled a spade, meliorates the fruits of the earth, and administers to our gratification. The geographer, who never travelled abroad with merchandize and

* Rousseau.

and wares, yet facilitates navigation and trade. The astronomer, who never saw the ocean, yet in his observations of the heavens, informs the mariner how he is to direct his course through the trackless deep, and thereby saves from wretchedness and death, millions of contemporaries, and those even yet unborn.

But, it is not necessary to dilate rapturously on the arts and sciences which have proceeded from the intellectual energies of man. Their benefits announce themselves. The world is filled with them By these, the dispersed nations of mankind have been brought together, cities have been built, and wandering tribes have been softened, polished, and rendered capable of society. Some have been destined to serve, and others have been destined to charm us. In short, they have shewn themselves to us, as another order of elements, the creation of which nature reserved for our own industry. How delightful to reflect on this general diffusion of happiness, and more particularly on the probability, that what has so successfully been propagated, may not speedily be lost! The benefits of law and policy, of trade and manufactures, of arts and sciences, are solid and permanent. Fortunately, the more useful, or at least more necessary

sary arts, can be performed without superior talents. Each village, each family, each individual, must (unless the face of nature be again changed) always possess both ability and inclination to perpetuate the use of fire and metals, the propagation and service of domestic animals, the methods of hunting and fishing, the rudiments of navigation, the cultivation of corn, and the simple practice of the mechanic trades. Private genius, and public industry, may be extirpated, but these hardy plants will survive the tempest, and strike an everlasting root into the most unfavourable soil. The splendid days of Augustus and Trajan were eclipsed by a cloud of ignorance, and the northern warriors subverted the laws and the palaces of Rome. But, the schythe still continues annually to mow the harvests of Italy; and the human feasts of the *Læstrigons*, have never been renewed on the coast of Campania.*

After the degradation which the surviving few of a calamitous disaster, such, for instance, as a deluge, must inevitably have fallen into, it would be some time before the human intellect could recover and re-assume its native vigour. The first moment, however, their descendants begin to

* Gibbon.

to feel they are more valuable for their mental than for their bodily faculties, some one or other, more enterprising than the rest, and inspired by the energy of real genius, turns his eyes on the open volume of nature. He admires the magnificent order of things, joined to their infinite variety. He sees that nature is simple in her ways, but without monotony; rich in her attires, but void of affectation; regular in her plans, and inexhaustible in her springs. In what sublimity does the bounty of Providence shine upon earth! A pure light, which gradually stretches from east to west, alternately gilds both hemispheres of this globe. It is surrounded with a light and transparent element. A mild, and fertile heat, animates and unfolds all the germs of existence; and they are nourished and supported by wholesome waters. Various eminences distributed over the surface of the land, stop and collect the moist vapours which float in the air, and give rise to perpetual fountains. Immense cavities, destined for the reception of these waters, separate islands and continents. The extent of the sea is as great as that of the land. This is not a cold and barren element. It is an empire equally rich and equally peopled. The limits of the waters are marked by the finger of God. Nature is the variegated display of the Divine

Magnificence. Man, who contemplates her, rises to the throne of the Almighty. Formed to adore his Creator, he has dominion over every creature. The vassal of heaven, the lord of earth, he peoples, enobles, and enriches this lower world. To nature herself he even gives embellishment, cultivation, extension, and polish. He cuts down the thistle and the bramble; and he multiplies the vine and the corn. View those melancholy spots where man has never resided! On the contrary, how beautiful is cultivated nature! How pompous and brilliant, when decorated by the hand of man! He himself her chief ornament, her first production. By multiplying his own species, he increases the most precious of her works. She even seems to multiply in proportion with him; for by his art, he brings to light every thing which lay concealed in her bosom. What a source of unknown treasure! Flowers, fruits, and grains, matured to perfection, and multiplied to infinity; the useful species of animals transported, propagated, and increased without number; the noxious kinds diminished; gold, and iron a more useful metal, extracted from the bowels of the earth; torrents restrained, and rivers directed; even the ocean itself subdued, investigated, and traversed from one hemisphere to the

other; the earth every where accessible, and rendered active and fertile; the vallies and plains converted into smiling meadows, rich pastures, and cultivated fields; the hills loaded with fruits, and their summits crowned with useful trees; the desarts turned into populous cities; open and frequented roads every where established, as so many evidences of the union and strength of society. A thousand other monuments of power and skill, sufficiently demonstrate that man is the lord of the earth, and that he has entirely changed and renewed its surface. He reigns as it were by the right of conquest. Accumulating in himself the experience of his whole species, and of many centuries, he extends the limits of his being to infinity.*

Has man, then, ground to look upon his lot as that of a common one? I know it is not unusual even to rail at every moral and at every physical dispensation in the world. Why should we have death, says one philosopher? If you reply, that death, by multiplying the number of animated beings, increases the general stock of happiness;—another will ask, why are we obliged to toil and labour, it is not so with other creatures? If you answer, were we exonerated from labour,

* Buffon.

labour, our time would hang wretchedly upon our hands;—a third will demand, why we have not the instinct that regulates the actions of other animals? and will, perhaps, scarcely be silenced by being asked, if man, like them, knew, on his first entering the world, all that he was afterwards capable of acquiring; what would have been his situation, or where would be the subjects for subsequent and progressive gratifications? It is poor ingenuity to arraign our species, and to give an unfavourable picture of mankind. Every animal is made to delight in the exercise of his natural talents and forces: the lion and the tiger sport with the paw; the horse delights to commit his mane to the wind, and forgets his pasture to try his speed in the field; the bull, even before his brow is armed, and the lamb, while yet an emblem of innocence, have a disposition to strike with the forehead, and anticipate, in play, the parts they are doomed to sustain. Man, too, is disposed to employ the forces of his nature: he loves to bring his reason, his courage, as well as his bodily strength to the field. He was not made to live for ever. His love of amusement even opens a way to the grave.*

* Ferguson.

Nil mortalibus arduum est,* has been said from the beginning of the world, and will be repeated to the end of it. But, why debase human nature, in order to humble human pride? Among the animal tribes, the genuine character of the law of nature, as relative to the human species, is no where to be found. The ancients in fable, brought down, indeed, the Father of Gods and Men, and made him associate with bulls, and goats, and the other commoners of the field. But does this prove us of the same nature with the bull and goat, and the other commoners of the field? Our knowledge, it is true, is confined to very narrow limits. Natural bodies, each in their form, are only constituted by certain modifications, circumstances, and qualities of rest or motion, of figure or arrangement, of quantity or situation, in parts so imperceptible that our senses cannot reach them; so that in order to discover what they are, we have no other resources but conjectures and systems, examples and comparisons, and probabilities or possibilities, which at bottom afford us little certainty. But, this is not the case in regard to intellectual endowments, or to the combined mental energies of the human capacity.

Man,

* Horace.

Man, notwithstanding all the activity of his mind, is, it must be confessed, an animal in the full extent of that designation. When the body sickens, the mind droops; and when the blood ceases to flow, the soul takes its departure. Charged with the care of his preservation, admonished by a sense of pleasure or pain, and guarded by an instinctive fear of death, nature has not intrusted his safety to the mere vigilance of his understanding, nor to the government of his sometimes uncertain reflections. With all his sagacity, his precautions, and his instincts, which are given to preserve his being, he partakes in the fate of other animals, and seems to be formed only that he may die. Myriads perish before they reach the perfection of their kind; and the individual, with an option to owe the prolongation of his temporary course to resolution and conduct, or to abject fear, frequently chuses the latter; and by a habit of timidity, embitters the life he is so intent to preserve.* But shall we, in consequence of this, debase ourselves to the most inextricable depth of brutality? Not certainly born into this world, in a supernatural state, nor in our material frames allowed an eternity upon earth, it yet is dreadful to plunge ourselves into the

* Ferguson.

abyss of positive annihilation. "Supposing our monopoly of reason," says Bolingbroke, "would not you choose to walk upon four legs, to wear a long tail, and to be called a beast, with the advantage of being determined by irresistible and unerring instinct, to those truths that are necessary to your well-being, rather than to walk on two legs, to wear no tail, and to be honoured with the title of man, at the expence of deviating from them perpetually?"*

It has long been a favourite theme with Pyrhonists, that man is not possessed of free will, but that inferior even to brutes, he is inevitably hurried on by the impulse of fatality. We are not masters of our conformation, say they—this we hold from nature; we are not masters of our ideas, or of the modification of our brains—these arise from causes of which we are in utter ignorance; we are not masters of our passions of love and desire, of hatred and otherwise—these do not depend upon ourselves; we are not masters of our choice of that which shall be eventually to our advantage; nor are we so much masters of ourselves, as to be capable of acting otherwise than we do. Thus, for instance, the will, whatever it be, causes deliberation; the deliberation,

* Letter to Lord Bathurst.

ation, whatever it be, causes choice; and the choice, whatever it be, causes action. Now liberty is neither in the will, the deliberation, the choice, nor the act. The determination makes us execute what the deliberation made us choose; and these all arise because we cannot avoid them. In short, the question may be in this manner fairly stated: the moment the mind acts, it could not act otherwise; the moment it makes a choice, it could not choose otherwise; the moment it deliberates, it could not deliberate otherwise; the moment it wills, it could not will otherwise; for a thing cannot exist, and not exist at the same time. *

But, this is sophistry. The will of man is free, and has entire liberty. He feels the disposition within himself, of a capacity to act or not to act, to choose or not to choose a thing at the same moment. The consequences which result from the doctrine of fatality, are still more dreadful than they are absurd. I would not think of God at all, exclaims a philosopher, though he ought to be always present to my thoughts; I would refuse to acknowledge and adore him in the contemplation of his works, though I do it from the bottom of my heart, rather than I

* Syst. de la Nat,

would look upon him as the immediate efficient cause of every sensation of human minds, and every action of human bodies. Shall I believe it is God who moves the arms of a parricide, when he plunges the dagger into his father's heart? It is true, indeed, in the hurry and bustle of the world, the ideas we have of truth and falsehood, of virtue and justice, seem in general to be nothing more than the result of temperament modified by society. We seldom feel shame or remorse, for actions which we see practised and approved by the rest of the world. Under corrupted governments, the venal, the avaricious, the mercenary, do not blush at the baseness, the rapine, the robbery, which is authorised by example. In licentious societies, no one blushes at seduction, and the interminable chain of domestic misery from adultery. In countries of sanguinary superstition, no one blushes at holy assassinations, committed for opinions. Robbers, assassins, and the immoral herd, have neither shame nor remorse among themselves. Hobbes even ventures to assert, that right or wrong, just and unjust, have no foundation in the nature of things, but depend entirely on positive ordinances. "The rules or distinctions of good and evil," says he, "honest and dishonest, are mere civil constitutions; and whatever the chief magistrate

gistrate commands, is to be accounted good; whatever he forbids, evil." It is the law of the land only which makes robbery to be robbery, or adultery to be adultery. *Si tamen lex civilis jubeat invadere aliquid, non est illud furtum, adulterium, &c.** "Nay," continues he, "the commandments to honour our parents, to do no murder, and all the other laws of God and nature, are no further obligatory, than the civil power shall think fit to make them so."

The omnipotency of a human legislature, politically speaking, we have often heard of. But I much doubt, whether you ever before heard of human laws that were capable of making light darkness, and darkness light; or of rendering sweetness bitter, and bitterness sweet. Nature, at a partial glance, would not, indeed, seem to have formed man, originally, compassionate and just. All men have not pity, savages but little, children less,—they frequently do not display even the least signs of such a sentiment. If then it be an *innate* sentiment, it is asked, why is the human heart void of it in its infancy? Or why in those that are insane from their birth, should this principle be likewise wholly imperceptible, seeing they are not deprived of the other faculties of the soul?

* De Cive. c. 14. § 10.

soul? Does it not rather shew that pity is an artificial sentiment, acquired in society, and that it is founded on the idea of pain, and the relations in which man stands with respect to sensible beings, for to pity the miseries of others, must not he first have an idea of them as relative to himself?*

There is in the soul an *innate sentiment*, prior to all sensation, and to all ideas with which nature has connected the preservation of human beings, the sentiment of *self-love*, which irresistibly directs mankind in most of their actions, often without being perceived,—the source of every passion, and to which all our desires are directed; the instigator, it is true, sometimes, of cruel deeds, and of foul depravity; but, more generally, the inspirer of kind and benevolent actions. Thus, is not maternal affection an inherent principle of this latter denomination? Certain authors indeed tell us, the mother first nourishes her little ones for her own, and afterwards for their good. But, how did the first mother know that suckling her child would be of service to herself? Besides, in how many other instances doth this affection appear? Constraint, disagreeable offices, every kind of self-denial, become

* Essay on Man.

come pleasing tasks to a mother; and however troublesome, she yet constantly discharges them at the expence of her pleasure, rest, and often of life itself. How many dangers do some mothers voluntarily undergo, for the preservation of their offspring? It is no less absurd to deduce this affection from friendship. On what ideas of the merit of a new-born infant, incapable of communicating any pleasure, and scarce one remove from stupidity, can it be founded? But, in fact, though in some nice cases, the bounds of right and wrong may be somewhat difficult to determine, and though in some plain cases, the laws and customs of certain barbarous nations may be contrary to one another, which have been looked upon as a just objection against the doctrine of a natural difference between good and evil; yet, in reality, these no more disprove the natural assent of all men's unprejudiced reason to the rule of right and equity, than the differences of most men's countenances in general, or the deformity of a few monsters in particular, prove there is no general likeness or uniformity in the bodies of men. For whatever difference there may be in some particular laws, it is certain, as to the main and principle branches of morality, there never was any nation upon earth, but owned, that to worship God, to be grateful to

benefactors, to perform equitable compacts, to preserve the lives of innocent and harmless fellow-creatures, and the like, were things fitter to be practised than the contrary.* The which, to suppose dependent on the opinions of men and the customs of nations, that is, to suppose that what shall be accounted the *virtue* of a man, depends merely on imagination or custom to determine, is as absurd as it would be to affirm, that the *fruitfulness* of a tree, or the *strength* of a horse, depends merely on the imagination of those who judge of them. *Hæc autem in opinione existimare, non in natura ponere dementis est. Nam nec arboris, nec equi virtus quæ dicitur, in opinione sita est, sed in natura.*†

But, if we have not free will, why is it that philosophers waste their time and expend their ability in preaching to us? I must be as I am; I must do as I do, according to their hypothesis of necessity. Can they fancy they can illuminate those who, in fatality, have been given over to darkness? Where there is no liberty of action, there labour can be but as chaff before the wind. If necessity fetters me, and I cannot choose my way, in that necessity I must mechanically grope along. But, where is this to stop? Can we

* Clarke. † Cicero.

we with justice condemn a Nero, or a less mighty villain? Are they more guilty, if fated to their crimes, than the brute stone which the wind loosens from the wall, and which wounds the unwary passenger? When Helvetius and d'Alembert argued for necessity, when the latter even said, he saw nothing *dans la machine humaine qu'une suite de mouvemens dépendans les uns des autres, & dont nous ne sommes nullement les maîtres depuis le premier instant de notre existence:* he surely could not have recollected, that this was letting loose the blood-hounds of unbridled passion on the world, sanctioning vice, by the irrevocable stamp of a blind and indiscriminate fatality. What renders such doctrine still more extraordinary, is the eagerness for which these very philosophers themselves contend for an *indefinite liberty*; for a liberty of thought; for a liberty of conscience; for a liberty of conversation; for a liberty of action; for a liberty of writing. I never heard that oaks, elms, or willows, (which, if we have no free will, may be, for aught I know, as capable of instruction as we are) have ever been addressed, or have ever found benefit from the ponderous folios of this levelling philosophy. What a whimsical *parterre* might be displayed in this garden of necessity. There let us plant the moralist, a vegetable of

sentences; there the rogue, a vegetable of crimes; there the sceptic, a vegetable of doubts; there the atheist, a vegetable of absurdity; and there the materialist, a vegetable of contradictions.

The systems of modern invention are incomprehensible. They are, if I may be allowed the comparison, like the ingredients of Pandora's box; those fatal treasures, from which issued good and bad, virtue and vice, truth and falsehood, reason and folly, light and darkness. Each fabricator professes to make nature his text, and reason his comment: but, the comment runs mad; and instead of that order and sobriety, which the calm contemplation of nature, and the just cultivation of reason, would present you with, he gives you an incoherent detail of all that is wild, and all that is extravagant in opinion. But, will all this temerity of doctrine advance the health of my body, or promote the peace of my soul? Will it enlarge my understanding, correct my passions, purify my heart, or refine and exalt my nature? What benefit will the human species reap by the propagation of this strange commodity? Will civil life be adorned, or moral virtue be improved by it? Or has it any tendency to introduce a general reformation, and thereby a new accession

of

of happiness to the world? Does the creation, viewed in the light of this comfortless philosophy, shine with more lustre, or present us with more beauty? Does God appear more present in his works, or man more happy under his government and protection?*

It is humiliating to behold genius, which, like the adventurous eagle, can soar into the most elevated regions, and can there, with dignity, support the sublimity of its situation; yet laying aside the calmness of reason, rashly presuming to command the ætherial fluid by which it is surrounded, and proudly conceiving itself endued with intellect sufficient to direct the storm which rages in the clouds. In the progress of our research into the animal man, we have seen him unmercifully dealt with. His mind we have seen stripped of innate intelligence; his understanding of the use of language; and his actions of the freedom of choice. And yet all these gifts have been admitted in the brute. Yet, is it not clear, that as man evidently partakes of the properties of all animals, and they only of the properties appropriated to each species, so must he at least have a superiority in the number of his powers? Thus, every dog is faithful; every lamb is gentle; every lion is fierce; every tiger

* Hunter's Character of Bolingbroke.

tiger is treacherous; every bee is industrious; and every dove is affectionate. But, is not man observed to be each and all of these by turns? Is he not found to have implanted in him the germ of every disposition? This abridgment of every thing; this creature, who has the fixity of metals, the vegetability of plants, the sensitive faculty or instinct of animals, and the intelligence of immateriality; surely this creature cannot be in his origin inferior to those whom he so essentially surpasses. Take him as he is. Some animals, indeed, you will find, who have a quickness of sense, superior to what we experience. But, these animals hardly excel us in more than *one* point, which is their peculiar share of perfection. On the contrary, consider man, who, from the re-union of his senses, is informed of what concerns him all over the earth, and even of what God has done for him in ages past. His organs are so exquisitely matched, that by their help, reason keeps a correspondence with the universe at large. The senses are the monitors and ministers of her domestic government; and the faculty of intellect, the power with which she sways the distant world.

But, of all our deprivations, in the present fashionable lopping philosophy, there is not one formidable

so keen, as that of our not being intended for society. The eloquent spinners of paradox, who thus set us adrift, talk so fluently, appeal so familiarly to the most venerable authorities, assert so roundly, and with an air of such superior wisdom, and tone of infallibility, that they in reality force undue predilection, if not absolute submission to their decisions. "Is it not plainly contrary to the law of nature," says Rousseau, "that infants should command old men; fools conduct philosophers; and that the privileged few should gorge themselves with superfluities, while the starving multitude are in want of the common necessaries of life?" This is certainly a sad and lamentable deviation. But the abuse of a thing, does not annihilate its original use. Nor can any of the inconsistencies observable among the communities of mankind, authorise us to imagine, that the natural state of man is a state of solitude and independence. On the contrary, we were clearly intended for society and subordination. All the effects of human art are parts of human nature, because the power of producing them is bestowed upon us: and hence, it is as natural for men to build cities, as for birds to build nests. We are social, because we are rational. * And this union with our species, we

* Marcus Aurelius.

have a right to consider as the noblest part of our fortune. From this source, we derive not only the force, but the very existence of our happiest emotions; not only the better part, but almost the whole of our rational character. Send man to the desart alone, he is a plant torn from its roots: the form may indeed remain, but every faculty droops and withers; the human personage and the human character cease to exist.

Among the ancient philosophers it was a frequent saying, "that the wise man was sufficient for himself." By this, however, they did not mean, that this personal sufficiency, this effect of wisdom, was only to be found in a savage insulated state. But, let us picture to ourselves one of these unsocial, haughty, distant characters, who approximate us so kindly to monkies. In order to free himself at once from a society of ignorant, troublesome people, our wise man begins by making a spiteful and general restitution of whatever he has received at their despicable hands. Clothes, arts, trades, instruments, sciences, religion, all, in short, wholly abandoned and forgotten by him. Away he goes, and confines himself to a profound solitude. Here he new-coins all his notions, and will shortly spin out

out of his head a body of pure and sublime speculations, from which all necessary inventions will flow of course. But how vain and empty all those projects and hopes! Living goes before philosophizing. The want of the commonest necessaries of life, will crush him and his philosophy together. All other animals come into the world provided with every thing necessary for them; but man, when he comes into the world, and our philosopher, when he enters into his solitude, are both destitute of clothes and provisions of all kinds. In the mother, however, the infant finds a provider. But our philosopher, now pursued by hunger, then shattered by hail, then successively scorched by a burning sun, or chilled and drenched by a deluge of rain, begins to think in good earnest, how, and with what tools he shall turn taylor, architect, and gardener. Let there be a general and mutual attraction among bodies; or let that attraction be a philosophical dream: let fire be, or not be, the principle or modification of electricity: let the spring of the air, dilated by the returning heat, be, or not be, the cause of the ascent of fluids in plants:—these questions, nevertheless, must be forborne, and speculative philosophy be laid aside. See how he sweats at hewing that rough stone. But, where are the tools to build himself a roof; or

how will he contrive an equivalent for a chair, a bed, a mat, or barely a plain earthen pan? The things on which he shall have bestowed most of his time and trouble, will break in his hands, or do him but very indifferent service. He will reach the end of his life, before he has replaced, I will not say, the conveniency of the pendulum of a clock, or a mill, but the matter of a thread, strong enough to twist without breaking; or of a tolerably fine needle; or the supplement of the most uncouth hedging-bill. Alas poor wretch, he now sees the fruitlessness of his extravagant opinions; and his total deprivation of the finest branches of knowledge, and of the most expeditious practices, by renouncing the assistance of others, and the experience of past ages. Since then, a total absence from society, throws us into an universal and truly moral indigence, society is, strictly speaking, as precious to us, as our very existence. *

Born to numberless wants, which his imagination also increases, man who exists but in the moments that are ever fleeting from him, by hope, seizes on futurity, and by remembrance, retains his hold of the past. Desirous of every species of gratification, he would extend his connection

* Spect. de la Nat.

connection to every period of existence, and would willingly be contemporary with all that has, and all that shall be. In language, in writing, in sculpture, in design, he has established a permanent record of things, and consolidated, as it were, not only facts, but, even the ideas of his fellow-creatures. Vice is not natural to him, he derives it from those fictitious wants, which grow with the progress of society. Before property becomes the means of procuring sensual pleasure, civil restraints are superfluous, and morality itself an unnecessary study. The vices of barbarians proceed from prejudice, and their virtues from nature. And yet, every day proves to us, that though in large societies there may be found a too great latitude of indulgence, yet it is in those societies alone where the happy equilibrium is found established between our physical and our moral dispositions. Mankind feel more for themselves from reflection, than from instinct: and nothing is so certain, as that our faculties in general are to be strengthened and improved by use and emulation.

Yet, how incessantly are we called back to a state of nature. Look at those happy, uncultivated, barbarous tribes; how calmly their time passes away; how chearfully they get

through their labour; how soundly thy repose, and how enviable their freedom and independence.

"O happy Laplander," says Linnæus, "who, on the utmost verge of habitable earth, thus livest obscure in rest, content, and innocence. Thou fearest not the scanty crop, nor ravages of war; and those calamities which waste whole provinces and towns, can never reach thy peaceful shores. Wrapt in thy covering of fur, thou canst securely sleep; a stranger to each tumultuous care; unenvying and unenvied. Thou fearest no danger, but from the thunder of heaven. Thy harmless days slide on in innocence, beyond the period of a century. Thy health is firm, and thy declining age is tranquil. Millions of diseases which ravage the rest of the world, never infected thy happy climate. Thou livest as the birds of the wood; thou carest not to sow or reap, for bounteous Providence has supplied thee in all thy wants." *

But, let me humby ask to be informed, whether any of the brilliant advocates for savage nakedness, both mental and corporeal, have ever beguiled their tedious hours, among the tribes they

* Flora Laponica.

they so seducingly hold forth? Do they know what it is to dwell in societies, where the animal is every thing; where sentiment is scarcely felt; and where unblushing instinct usurps the place of reason? Arts, sciences, laws, morality, and religion, teach men to discriminate. But, is it to be imagined, that the intercourse of man with man can be comfortable, when neither arts, sciences, laws, morality, nor religion, are to be met with? In no situation is the human character so lovely, as when cultivated. Large and polished societies, undoubtedly, present dark shades. But, do they not also abound in excellence and lustre? Again, I would beg leave to ask, whether any of these lovers of barbarians, have ever chosen these uncultivated societies for their own immediate residence? On the contrary, London, Paris, Venice, Rome, Vienna, &c. have always had superior attractions to Lapland, Kamschatka, the huts of the Valais, or the cottages of the Grissons. It is absurd to say, that elegancy and refinement are injurious to humanity. The imperfections of our nature are indeed more easily discerned in a large cultivated society, than where there is no permanent society at all; because, we look more narrowly into each other in the city, than in the forest; and because there is in civil life what savage life cannot furnish,

guardians to watch, and laws to punish the wicked and disorderly. All that is good, and all that is bad, is certainly to be met with in large assemblies of men. But the man of the woods is not more virtuous than the man of the palace. The lights of science, and the polish of society, I must then assert, are neither of them contemptible, excepting, indeed, to those who are shocked by excellence, and who cannot bear an equal, much less a superior.

And now I think we have had enough on this not unfruitful subject. Experimentally established, or metaphysically deduced, our rank is certainly the first in the sublunary order of things; and evidently proves that seductive, chimerical reasoning, is of little utility, while one good current principle, one that in its consequences can be beneficial to humanity in a state of society, is of infinitely more value than the most refined but barren solitary speculation. In the relative capacities in which we stand to one another; in the rise and fall of his own species, let the man of wisdom look for the most curious, and at the same time, the most instructive object of contemplation. Extravagant imaginations may, no doubt, sometimes rush into the mind; but, then, let us say to them,

them, as Marcus Aurelius did: "Begone. Go as you came, for I have no use for you. You have come, I know, according to old custom. I am not angry with you; only begone."

LET-

LETTER LVIII.

MEN who are fond of solitude, are generally misanthropic and melancholy; nor is it unedifying to see how constantly they are employed in declaiming against that human species, with whom they have broken off all connection; and how satisfactorily they employ themselves in satyrizing and tearing the propensities and dispositions of those, whom they will not know, and from whom they can receive no chastisement or retalliation. "In fairness," says Balzac, "I must confess, *que la solitude est certainement une belle chose: mais il y a plaisir d'avoir quelqu'un qui sache repondre, et à qui on puisse dire de tems en tems, que la solitude est une belle chose.* Turning over books, turning over systems, turning over the whole series of absurdity and contradiction, in search of what mankind originally were in respect to intellect—no understanding will ever get near to it, believe me, unless it be in the midst of society. Moreover, what nature

can

can we honour, if we honour not the human? But, let us here stop—and as from a center, quitting man, take a general survey of the other parts of animated nature.

After man, whose organization and intellects demand precedency in terrestrial creation, the rest may be arranged into eight orders—*Quadrupeds*, *cetaceous*, *birds*, *amphibious*, *fishes*, *insects*, *worms*, and *polypi*. * It would be possible to multiply these classes; but, perhaps, in so doing, we should be only multiplying our difficulties.

In zoology, quadrupeds come immediately after the human species. They breathe through lungs, similar to those of man. Their heart, like his, has two ventricles. They are viviparous. They approximate the nearest to him from their structure. There are even those, such as the ape tribe, who have an extraordinary similitude. Linnæus divides the quadruped class into six orders, which he characterises from the number, figure, and disposition of their teeth. The first order he calls *thropomorpha*, from their resemblance to the human shape; the second, *feræ*, or beasts of prey; the third, *agriæ*, as distinguished

* Fourcroy.

guished by having no teeth at all; the fourth, *glires*; the fifth, *pecora*; and the sixth, *jumenta*. With respect to amphibious animals, of those he made a class, the first order of which contains the tortoise, the frog, the crocodile, the lizard, the salamander, the cameleon, &c.; and the second, the serpents. But, besides the quadrupeds, generally received as such—bats, from whom, by the way, the ancients took their ideas of harpies, are nothing esle than quadrupeds. Except the faculty of flying, they have nothing in common with birds. The lungs, the heart, the organs of generation, and all the other viscera, are similar to those of quadrupeds, except the penis, which is pendulous and loose, a thing peculiar to man only, to monkies, and to bats. Like quadrupeds, they are viviparous. It is said, they bring forth ordinarily two at a time, and that they suckle their young. * And hence, even as well as the whale, they have been confounded under the class, *mammalia*.

The amphibious tribe may be divided into, first, those that perform their chief functions by land, but who occasionally go into the water: and secondly, such as chiefly inhabit the water, but occasionally

* Buffon.

occasionally go on shore. It is well known, that the essential difference (as to the general structure of the heart) between amphibious and mere land animals, is such, that the *foramen ovale* remains always open in the former; through this there is a communication, and the circulation is kept up, though the animal does not respire while under water. Nor is this different from the circulation in the human fœtus. In the fœtus state, the lungs are collapsed, and are in a great degree impervious. After birth, respiration takes place, the passage through the lungs becomes free; and the foramen ovale, with the *canalis arteriosus*, is closed. Hence the whole mass of blood must necessarily afterwards pass through the lungs; and consequently when respiration ceases, and this passage through the lungs is obstructed, whether from immersion in water, or from any other cause, the circulation is suppressed, and death must immediately ensue. With regard to the first class of amphibious animals, they are obliged to repair to the land, because they have lungs. The *phocæ*, which are of this tribe, are real quadrupeds. They go out to sea, to hunt their prey, and to great distances from shore; and can remain for an hour or two under water. The phoca frequently plunges her cub into the water, to keep the foramen

ovale

ovale open. Some think, the same practised on the dog, would have the same effect. * Others go further, and think it might with equal success be practised on man. † Otters, beavers, rats, crocodiles, frogs, the hippopotamus, and the lacertæ aquaticæ, are of this class. The second class contains eels, water serpents, or snakes of every kind. The gills or branchiæ of fish, are analogous to the lungs of land animals. Air is necessary to the proper action of the lungs; and water is, in like manner, necessary to keep the gills of fishes in their proper state: without this, they soon grow crisp and dry. The blood is obstructed in its motion, and they die. Eels, &c have their gills well covered with mucus; and their bodies well furnished with it. Hence they do not become dry, though exposed for a considerable time to the air. And hence, though their proper residence be water, they can live much longer in the air, than the other kinds of fish. ‡

It is unnecessary for us to enter into a minute detail of the figure, temper, disposition, and habit of the various quadrupeds with which the earth abounds. It is sufficient to trace a few leading features. Thus, when we see the shapes, the

* Parsons. † Buffon. ‡ Parsons.

the inclinations, and the internal conformation of seemingly different creatures, nearly the same, and above all, when we see them producing amongst each other, we then have the authority of general assent, to pronounce them of the same species. Horns, hair, or colour, by themselves are not to be considered. For instance, the buffalo, though shaped like the cow, and though it has other properties like her, is not of the *bison* species, and never mixes with them. It goes twelves months with young, whereas the cow goes but nine; and even testifies an aversion to the latter. Ruminating animals, as those who chew the cud, are furnished with four stomachs. Cows, sheep, and deer, are properly so called; though there are many animals, birds, and sea fishes, that appear to ruminate; such as the camel, horse, rabbit, marmotte, and squirrel; the pelican, stork, heron, pigeon, and turtle; the lobster, crab, and dorado. Those, however, who do properly ruminate, are without the upper teeth. Men even have been known to chew the cud. All animals in general of solid horns, such as the deer, shed them annually. Those that are hollow, continue fixed. Castrate a stag, when his horns are fallen off, and they will not grow again. Castrate him when they are on, and they will not fall. If only one of his

testicles be taken out, he will want the horn on that side; and if one be only tied up, he will want the horn of the opposite side. The same is to be observed of tusks in regard to the organs of generation. When castrated, the tusks never grow to a full size. Even a boar, if his tusks, by any any accident or design, be broken away, abates of his fierceness and venery; and it produces nearly the same effect upon his constitution, as if he were castrated. * Does not the beard of man, exhibit a striking analogy to the horn and the tusk of the brute?

In man, and most other animals, the pupil of the eye is capable but of small contraction or dilatation. It enlarges a little in the dark, and contracts a little in the light. The eyes of the cat species, however, become all pupil as it were. By day-light, indeed, it appears narrow and small; but by night, it expands over the whole surface of the eye-ball. By this peculiar conformation, they see better by night than by day. Thus the lion, the tyger, and all the varieties of the cat tribe, are kept off by fires and light at night. In the day, they seldom prowl abroad, the glare seeming too powerful for them. This whole race may be considered as the most formidable

* Animated Nature.

formidable enemies of mankind. There are others stronger, and in greater numbers, but they are docile, and without much difficulty tamed. But, these absolutely keep kingdoms of the earth in their own possession. The dog is the most intelligent of all quadrupeds; the acknowledged friend and companion of the human species. In his savage state, he is fierce and formidable, but he is easily tamed; and then crouching along, he lays his force, his courage, and all his talents, at his master's feet. By his assistance, man has been enabled to conquer, tame, and reduce to servitude, almost every other animal. By conciliating the favour of the dog, the conquest and peaceable possession of the earth has been accomplished. Of this class is the wolf, fox, and jackall. A change of colour in the hair, or fur, prevails in almost every animal; in the excess of cold particularly. The cow, the horse, and even the goat, all manifestly change colour in the beginning of the summer, the old long hair falling off, and a shorter coat of hair appearing in its room, generally of a darker colour, and yet more glossy. Of all quadrupeds, the hare is the swiftest, for the time it continues; and few animals can overtake the rabbit, when it has but a short way to run. Their hinder legs are longer than their fore, which adds to the ra-

pidity of their motions; and almost all animals, that are remarkable for speed, are formed in the same manner. The hare is almost the only animal that has young at different ages, a *superfœtation*, often admitting the male, though impregnated already, and thereby laying the foundation of another brood. The squirrel is reckoned among the hare kind. Linnæus and other credible historians say, that in Lapland, and those extensive countries to the North, they change their situation, and migrate by thousands, crossing the broadest rivers and lakes upon little rafts, which each provides himself with, and which is kept in motion by the fanning of their tails. But the first and most noble of animals is the elephant. It is an ugly mass of animated matter: its nature yielding and obedient; its reason strong; its strength proportional to its amazing size: its generative powers fail in a domestic state. It is then never known to copulate, as if unwilling to propagate a race of slaves. It is faithful to its keeper, and has astonishing nicety of perception.* The sheep is the most numerous of quadrupeds, and the most common. It is found almost every where; and yet, unlike the other races, it is never found wild, or in a savage state. † Is it not remarkable, that sheep and

* Animated Nature. † Buffon.

and corn should seem as if they were both brought to us from some country, which to us is now no more.

And thus much for quadrupeds, though there are abundant materials for a more particular detail. But I know you will forgive me for not dwelling on the lungs of the fox, the liver of the wolf, the feet of the elk, and the grease of the badger; as you will for eventually not dwelling on the jaws of the carp, the nest of the swallow, the powder of the toad, the dung of the peacock, the heart of the viper, and the more physically valuable fat of the malefactor.

Icthyology, or the doctrine of the nature of fishes, teaches us, that those beings are very different in construction from that of terrene animals. They have fins instead of legs, wherewith they move. They inhale water instead of air. Their structure is wonderful. Their bodies are clothed and guarded in the best manner, with scales and shells, suitable to their respective circumstances, the dangers they are exposed to, and the motions and business they are to perform. They have several parts peculiar to themselves; as fins (as I have said) to keep and balance them upright, and an air-bladder to en-

able them to sink and rise at pleasure. They have little gills or branchiæ, whereby they respire as animals do by lungs. The tail is the instrument of progressive motion. Their eyes are peculiarly formed to enable them to correspond with all the conveniencies and divergencies of rays, which the variations of the watery medium and refraction may occasion; in which they bear a near resemblance to birds. In this manner, the ocean presents us with myriads of animated beings. Some garbed in light scales, swim with amazing swiftness; others loaded with thick shells, trail heavily along; and others totally deprived of loco-motion, live and die immoveably fixed to the same rock. As terrestrial animals are furnished with feathers, with down, with warm furs, or with long hair to defend them from the inclemencies of the air, so are fishes invested with a glutinous matter, perceivable at the first touch, with which the whole surface of their bodies is moistened: an exterior strong coating; and before we get to their flesh, an oily substance, which extends from head to tail, and surrounds the whole. These, from their solidity and immiscibility with water, keep their frames firm, and give them vigour and activity. They could not be furnished wih a lighter vestment, or one more impenetrable. What profusion,

fusion, what delicacies does not man receive from this element! Whole communities are supplied with a sufficiency, by the bare capture of a single day! What a precaution likewise in these gifts of Providence. Such fishes as are wholesome food, are exceedingly prolific: those, on the contrary, that are not so, are less prolific. The same wisdom also, that has regulated, with such indulgence, the bounds of their fecundity, keeps those at a wide distance from our shores, which we have the least occasion for, and puts others into our possession, which are most useful to us. * A cod will bring forth as many in a year, as the whole population of Great Britain is computed at. Above nine millions of eggs, or peas, have been found in a cod; one million have been found in a flounder; and five hundred thousand in a mackarel.

There are three grand divisions in the fish kind: the *cetaceous*, or those of the whale kind; the *cartilaginous*, or those who have gristles instead of bones; and the *spinous*, or those who have bones. All the cetaceous tribe resemble quadrupeds in their internal conformation. They have warm red blood, which circulates through their bodies; similar parts of generation; and

* Spect. de la Nat.

lungs, which drive them to the necessity of frequently rising to breathe the air. The breasts of whales are generally two, and are filled with large quantities of milk. The teats are like those of a cow, with which the young is suckled. One species of this animal, the narwhal, or sea unicorn, has the longest and most formidable weapon of any being in the world. It springs in general from the left side of the head, in a strait line with the body. In a skull at Hamburgh, there are two of their teeth, which are above seven feet long, and are eight inches in circumference; wreathed, tapering to a point, and harder, whiter, and heavier than ivory. Some whales have a very small gullet; whereas others, such as the cachelot, can swallow an ox. Fishes of eight or nine feet long are often found in their stomach. The substance called ambergrise, which was long unknown, is found, as I have already remarked to you, in round lumps, floating in a fluid, in the place where the seminal vessels are usually situated in other animals. And thus it is that the civic, the musk, and the castor, are situated in the inguinal regions of the civit cat, the musk deer, and the beaver. The spermacetti is the brain and oil of the cachelot.*

The

* Animated Nature.

The instinct, or the reason if you will, of fishes, however we despise it, is wonderful. They have their migrations as well as the fowls of the air: they travel in companies to distant coasts, for the sake of a succession to keep up the species, which they are never to see, and know nothing of: they all agree, without any voice or signal with which we are acquainted; and undertake the voyage, without any apparent consultation, one with another: they know nothing of the course of the stars, or of other phænomena observed above the surface of their element; nor do they, it is to be supposed, see very distantly their way. The variously refracted rays, must in some respect obstruct the sense of vision. Yet, this fish, for the preservation of its offspring, travels from the remotest parts, to deposit them in the river; that dives to the bottom, and in caverns skreens its young; while the slow tortoise moves to dry land, that its issue may be out of the reach of the waves. What shoals of cod, haddock, whiting, mackarel, tunney, herring, and pilchard, are annually observed to make their periodical emigrations!

The *crustaceous* kinds of fishes, are the lobster, the crab, and the tortoise or turtle. The *testa-*

ceous, are the oyster, the muscle, the cockle, &c. Every lobster is an hermaphrodite, and is supposed to be self-impregnated. They in general change their shell once a year. If a claw be broke or cut away, a new one will grow: a most surprising phænomenon—but not to be so large as the former one. The crab has the same properties. The tortoise has prodigious vital motion. Redi drew out the brain of one, and washed the cavity. This had no other effect, than to make the animal blind. It lived afterwards six months. After the head of one was cut off by the same philosopher, it had vital motion for three and twenty days. Almost all shell-fish, as well indeed as shell-insects, can mend their own shells. They are born with them: the snail with his little house upon his back, and the oyster with his shell. The reparation is performed with a slimy fluid or mucus, like that of the snail, which they extract from their own juices. All shells are formed of the same substance—of an animal or calcareous earth, which ferments with acids, and burns into lime; and hence the reason why chalks and marbles are said to be shells in a state of decomposition.

Testaceous fishes are divided into the *univalve*, *bivalve*, and the *multivalve*, or a corn-shell kind. The sea-snail, which is of the first kind, has its eyes on the points of its largest horns. Every snail is at once both male and female; and while it impregnates another, is impregnated itself. The oyster is formed with organs of life and respiration; with intestines which are very voluminous; with a liver, lungs, and heart, and is self-impregnated; but, unlike other shell fish, is unalterably fixed to one spot. The mechanical rationale of swimming in fishes, is the same as that of flying in birds: for the latter fly by striking the air with their wings, and the former by striking the water with their fins; since, as much as they strike the water backwards, the water re-acts, and strikes them forward with equal force. Though there is not the least appearance of ears, fishes are not therefore deaf. They have an auricular nerve, as has been explained by Hunter. As to their sense of smelling, this we are at present not thoroughly assured of, though Pontopidan tells us, the fishermen on the coast of Norway always carry musk in their pockets, when they have a prospect of meeting with the sea snake, the smell of which immediately forces the animal to dart away as expeditiously as possible. The method of respiration,

ration, is by passing the water, and the air contained in it, through the gills on each side of the head, which are in lieu of the lungs in quadrupeds. Fishes respire water quicker than we do air. This aqueous respiration keeps up the vital principle. The air-pump cannot deprive them of it, and therefore will not kill them; but, the water-pump, by taking away the water, soon makes them expire. The tongue of fishes shews they have a sense of taste. The eyes in general are perfect globules, in order that the focal distance may be very short, and of course the vision very distinct of objects near at hand. But, how comes it that fishes which are bred in a salt element, have yet no salt to the taste, nor any that is capable of being extracted from them? This is a question of something of the same kind with that—how is it to be accounted for, that in lakes, on continents, which had formerly been the *bottom of the sea*, there should be found such abundance of fish, which cannot live in the salt water element, but from which they must have proceeded?* That fishes are not salt, is a fact. Why they are not salt, I no more know, than why it is not given me to mend my finger, as it is given to the snail to mend his shell. As to the other, it may not be so difficult of solution.

* De Luc.

tion. The lakes which now are fresh, were, at their origin, probably salt. But, whence came the change? From the condensations of the atmosphere, I should suppose, into rain; and from the melting of snow and ice, in the higher parts of those countries, in which lakes and rivers are found. The first overflowings, occasioned by the atmospherical and glacial waters, would not only carry off variety of impurities, but would scoop out the beds of rivers, which attrition in time would widen. By these outlets, aided by an incessant succession of fresh element, the heterogeneous particles might be carried off, till, in process of time, the whole might become limpid and sweet. In regard to the existence of fishes in them, indeed, the matter is not quite so explicable. But, may not fishes be supposed to have changed their nature, or their particular habits, in the ratio of a change occasioned in their climate, and in the fluid by which they have been surrounded? We see salmon come every day from the sea into rivers. Porpoises are not unfrequently in rivers, and at a prodigious distance from the salt water ocean. But let me ask, in my turn, where did the fishes in the lake of Geneva, for instance, and in all the lakes in Switzerland, and in the neighbourhood of the Alps, come from, if they did not come

come from the ocean? They did not derive their being from the Glaciers. This you will allow. Either they, or rather their ancestors, were created in the very spots, those parts of the ocean, where their descendants now take up their abode; or they were deposited there by aquatic fowls, who, we know, live upon fishes and the eggs of fishes. The first of these is the most probable, for not only the bottom of many of these lakes is calcareous, but the very same stratum of decomposed marine bodies is to be traced from the summit of the Jura, to two-thirds of the height of the enormous Mont Blanc. Neither is the last altogether without probability: for water birds may be as readily conceived to transport the seeds of fishes, as land birds are to transport the seeds of vegetables. But which opinion is preferable, I do not determine.

All this, however, at the present moment, is more conjecturally amusing than physically important. Let us continue. Our next subject of attention is *ornithology*. The whole class of birds is arranged by Linnæus under six orders, according to the different figures of their beaks, viz. the *accipitres*, or birds with uncinated or hooked beaks; the *picæ*, or birds that have

convex

convex or compressed beaks; the *anseres*, comprehending such birds as have depressed and dentated or serrated beaks; the *scolopaces*, or those furnished with subcylindric and obtuse beaks; the *gallinæ*, or birds which have the beak of a conic form, but crooked, and the upper chap imbricated; the *passeres*, or birds with conic and sharp pointed beaks. Birds have been generally divided into terrestrial and aquatic, or land and water birds. In the description of birds, the feet, wings, and tail are chiefly attended to. In most birds, the toes are four in number; three standing forwards and one backward. In some, two toes stand forward, and two backward. Some feet, again, are palmated, or have the toes connected by a membrane; and others semi-palmated. With regard to the wings, the long quill feathers are called by authors remiges, as serving to fly with; and the other feathers, which cover the rest of the body, tectrices. The long feathers of the tail are called rectrices, as serving to steer the bird's course through the air. And almost all these feathers are inserted into the skin in such a manner, that they naturally lie backward from the head, and allow the rain to run off their bodies, and by turning their heads in opposition to the wind, prevent the wind from rumpling their feathers and retarding

their

their flight. As to the constituent parts of birds, it is remarkable that the head, excepting in a few instances, is small in proportion to the rest of the body; that the eyes are more plain and depressed than in quadrupeds; and that they have no external ear. Besides these, there are other distinctions of birds taken from their manner of feeding, as carnivorous ones, or birds of prey; frugivorous and granivorous, or such as feed on fruits, and the seeds of various plants; insectivorous, or those who feed principally on insects; and so in other cases. All birds are oviparous. Such eggs as have been impregnated by the cock are prolific, and such as have not (for the hen often lays without any congress whatever) continue barren, and are only addled by incubation.

Lest the feathers should spoil by their attrition in the air, or imbibe the moisture of the atmosphere, birds are provided with a gland behind, which contains a quantity of oil which they express at pleasure. And as they are continually passing through hedges and thickets, they are, for the defence of their eyes from external injuries, as well as from too much light, when flying in opposition to the rays of the sun, furnished with a membrane called *membrana nictitans*,

titans, which, like a curtain, can at pleasure be drawn over the whole eye. This covering is neither opaque nor pellucid, but being somewhat transparent, it allows as many rays to enter, as render any object just visible, and enables them to direct their progress through the air. It is by the instrumentality of this membrane, that the eagle looks at the sun.*

Almost every bird emigrates. They annually shift their quarters, either from one country to another, or from one province to a neighbouring one more agreeable to them. Birds, in general, are longer lived than the quadrupeds and insects of the same climate. Swans are said to have lived three hundred years. Geese are known to live to four score. The ostrich, which, in many particulars, is like the camel, forms the shade which unites birds and quadrupeds. Its speed is immense. The prolific power of birds is considerable. A hen of the poultry kind, will lay two hundred eggs in a year, in a domestic state. Birds may be tamed and trained as animals. The cocatoo, parrot, and some others, can move the upper chap; whereas it is in general of one piece with the skull. Other circumstances relative

* Smellie.

lative to birds, we have already had occasion to notice.

We now advert to *entomology*, or the doctrine of insects. Insects compose one of the most numerous classes of animals. The smaller they are the greater their numbers. They present a likeness to almost every other animal, both in regard to form, manner, and habitation. Some walk like quadrupeds; others fly like birds; some swim and live in water like fishes; and there are others that trail along like reptiles: and the analogy might still be pushed farther. But, the phænomenon the most singular in insects, and that which makes them differ entirely from the greatest part of other living beings, (for there are some, not excepting man, who evidently go through transformation) is the metamorphosis they undergo, before they become perfect insects. The insect does not come from the egg, in the form of its parent.* Insects may be classed into four tribes. Those who have no wings, and creep about till they die. Those who have wings, but so cased up when produced from the egg, that they cannot be seen. The third, those of the moth and butterfly

* Fourcroy.

fly kind, who have four wings, and a mealy substance of various colours. They are hatched from an egg, whence comes a caterpillar that eats and casts its skin. It then assumes a new covering, which is called a chrysalis; as in the cone, in the silk-worm, in which it continues hidden, till it comes forth a perfect moth or butterfly. The fourth, are those which come from a worm instead of a caterpillar, and yet go through changes similar with moths and butterflies, but have not the mealy substance. To which may be added, a fifth order, the *zoophytes*, which may be propagated by dissection, such as the polypus, the earth-worm, and all the varieties of the sea-nettle.*

The world is now generally convinced, that in the generation of insects, they are not bred of corruption, but *ex ovo*, though the contrary was believed by the ancients. Malpighi, Swammedam, and Redi, have confuted the doctrine of equivocal generation, and have shewn, that all the members of the butterfly are enclosed under the nympha or skin of the caterpillar, as the parts of a plant are in the seed. They deposit their eggs, when they can have sufficient incubation, in water, flesh, fruits, vegetables; in

* Animated Nature.

or about the bodies of animals, in the feathers of birds, hair of beasts, scales of fish; in short, in every accessible part of nature. The spider has sometimes six, and sometimes eight eyes; two behind, two before, and the rest on each side. To form its web, it is furnished with five teats, from which it extracts a glutinous substance, which it spins; so that the threads which we see, are five, twisted together. There are some flies, whose duration extends but to a day, and these are called ephemera; and even others which are born and die in the space of a single hour. Corals and spunges are entirely the work of insects, as the honey-comb is of the bee. They are the residence and the fabrication of aquatic animals; nor is the soft texture of these animals any difficulty in the way of such hard and such solid constructions. The snail, as we have seen, has a viscous substance which it can discharge, and with which it can mend its shell when it is fractured. This doctrine of Ellis is, I know, opposed; and it is said, that instead of the tenements, we must look upon them as the animals themselves.* "All these pores, madrepores, millepores, and corals," says Bonnet, "are nothing but masses or groupes of testaceous tubes, each of which, as a shell, is composed

* Herissante.

composed of an animal and an earthy substance, and are to their insect inhabitants, what shells are to the co-existing animals they contain." Be all this, however, as it may; these combs, these animals, or these animal vegetables, are in the sea, at least, what trees are on the land; they afford an asylum, and a place of rest, if they are not of the absolute formation of the animals themselves, which is clearly the most probable belief.

Worms, or vermes, are not destined to pass through the same changes of state with insects. This is the most numerous class, but the least known of animated beings. Worms have erroneously been classed with the polypi, even by Linnæus himself. But, there is a heart and vessels to be discerned in most worms, which are not to be found in polypi. No organic substance whatever, whether dead or living, in which certain worms do not find an existence. Almost all worms can be propagated by dissection, which, as in the polypus, proves a wonderful simplicity of construction. Nor can any thing in nature be more astonishing than this,—that man, at pleasure, shall have a kind of *creative* power, and out of one life make two; each completely formed, with all its apparatus and functions;

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each with its perceptions and powers of motion and self-preservation; each as complete in all respects, as that from which it derived its existence, and equally enjoying the humble gratification of its nature.* The polypi may be, as it were, *grafted* together. If the truncated portions of a polypus are placed end to end, and then pushed together with gentle force, they will unite and form a single one. Portions, not only of the same, but pieces of different polypi, may be thus united together. You may fix the head of one polypus to the trunk of another, and that which is thus produced, will grow, eat voraciously, and multiply like another. There is still another method of uniting these animals, yet more wonderful in its nature: it is effected by *introducing one within the other*, forcing the body of one into the mouth of the other, and pushing it down, so that their heads may be brought together. They then unite, and become one individual, with a large quantity of arms, and performs all its functions like another.† No animal in the world is so difficult to describe as this polypus: it varies its whole figure at pleasure, and is frequently found beset with young, in such a manner as to appear ramose and divaricated; the young ones adhering to

* Animated Nature. † Adams.

to it, so as to make parts of its body. When simple, and in a moderate state, as to contraction or dilation, it is oblong, slender, pellucid, and of a palish red colour: its body is somewhat smaller towards the tail, by which it affixes itself to some solid body, and larger towards the other extremity, whence it has a large opening, which is the mouth, around which are the tentacula, which are eight in number, and one usually extended to about half the length of its body. By means of these tentacula, or arms, as they are commonly called, expanded into a circle of more than half a foot diameter, the creature feels every thing that can serve it for food; and seizing the prey with one of them, calls in the assistance of the others, if necessary, to conduct it to its mouth.

Besides the common polypi, there is the hydra stentorea, or bell-polypus, which multiplies by splitting longitudinally. In twenty-four hours, these divisions will adhere to a common pedicle, re-split, and form four distinct animals. These four, in an equal time, again split; and then they proceed doubling their numbers daily, till they acquire a figure somewhat resembling a nose-gay. * The funnel-shaped polypus again

* Linnæus.

multiplies by splitting transversely. Of the individuals, accordingly, which proceed from this division, one has the old head, and a new tail; and the other, a new head, and the old tail. And such is also the mode of multiplication in the microscopic animalculæ of infusions. One was observed to divide into five, in the course of a day; to subdivide in the course of another day to sixty; and to be innumerable the day following.*

Every insect, that flies or creeps, is a little animal, consisting of several ringlets, which shrink from, or draw near to one another, by one common membrane, or skin, that connects them; or else of distinct scales, which play to and fro by gliding over one another; or, in short, of two or three principal parts, which have no other connection than a ligature, or little thread. The term *insect* is derived from the Latin verb *insecare*, to cut. Most of them have either strong teeth, a double saw, a sting with two darts, or else tenacious claws. Their whole bodies are covered over, and secured by a scaly suit of armour. Their security, for the most part, depends on their sprightliness and activity. Some, by virtue of their wings, avoid the

* De Saussure.

the danger that attends them; others, that dwell on the leaves of trees, precipitate themselves from their enemies by a fine thread that supports them; others again, by the elastic force of their hind feet, launch themselves out of pursuit. Among all there is a perpetual war; they subsist by the destruction of each other. Some insects employ their time in spinning. Some build in wood, and are therefore furnished with little hatchets for hewing their timber. Others are engaged in wax work, and have their cells and lodgments. Nature has bestowed on most a more commodious proboscis than that of the elephant, which some make use of as an alembick to distil a certain syrup, which all the art of man can never imitate; others, as a tongue, to distinguish what is most agreeable to the taste; some as a drill, or augur, for piercing solid substances; and all of them, or at least the greatest part, as a reed for suction. Some are not only provided with this trunk, but, with a kind of borer in their tails, and therewith dig lodgements for their young in the heart of fruits, the bark of trees, the most substantial part of leaves, and often in the most stubborn wood. Such as have curious eyes have likewise, for the most part, a pair of antennæ, or little horns, that guard and secure them. Others

are furnished with palpi, which serve them instead of hands. Most also, have the faculty of flying.*

The vulgar notion is, as I have above observed, and I am sorry to say it is even atheistically advanced by some philosophers, that insects derive their existence from corruption. But do such writers understand what they assert? Is not the corruption of a body, the dissolution of its parts? Is it to be supposed, that the internal parts of a piece of meat, blown and changed, should become better qualified, all at once, for the construction of an organized body, that has eyes, a heart and entrails, and in short every individual part that constitutes a living creature? The most minute worm, the least mite, has all these parts. I could as soon believe that rocks and woods engender stags and tygers, as that a piece of rotten cheese produces mites. No one thing in nature is the result of chance. Vinegar is full of little eels, because there is one little animal that knows that vinegar is most agreeable to the constitution of her young. I have already said, that most insects pass through a variety of transmigrations, and assume the form of two or three living

* Spectacle de la Nature.

living creatures successively, which bear no resemblance or affinity. In issuing from the egg, they are generally little worms, and nothing more; some with, and others without feet. The former take care of themselves; the latter are properly lodged by their parents. Several of them cast off their old skins, and assume new ones; then change them again and again at certain periods. All of them, who undergo a transformation, pass through an intermediate state, called chrysalis, nymph, cone, or bean. The minute worm ceasing to eat, encloses itself in a sort of tomb, or little monument. There under a cover, which preserves its surprizing delicacy from all injury, it is again conceived, and born again. Their last state is when they arise out of their dormitory, and become flying insects. It was long imagined, indeed, that an insect actually dies at the time of its transformation. It is a living creature, however, furnished with every member suitable to its nature; though it bears no manner of resemblance to the winged animal that is substituted in its room. Although it divests itself of its most essential parts, it yet does not inevitably die. The deprivation of the parts does not necessarily imply the ruin of the whole. A living

ing embryo, however, they acknowledge is contained in the preceding animal.*

Individual animation, is in all these cases unquestionably preserved. But, the phenomena of transformation are not, in fact, simply confined to change of appearance. The fabric, indeed of the body, the instruments of motion, and the organic system in general is changed. But, though the animal retains its identity, there is, I confess, a diversity in its manners and propensities. In the caterpillar state, those animals are extremely voracious, and, in many instances, acquire a greater magnitude than they possess after transformation; but, they are incapable of multiplying their species, and of receiving nourishment from the same kind of food. Flies, who now live upon the nectareous juices of fruits and flowers, in their first state fed upon putrescency. Some caterpillars, previous to their transformation, live even in a different element. The ephemeron fly, when in the caterpillar state, lives no less than three years in the water. After transformation, this animal seldom exists longer than one day, during which the species is propagated, and myriads of eggs are deposited on the surface of the water.

An

* Spectacle de la Nature.

An insect that must cast off its exuvia, or moult five times before it attains the pupa state, may be considered as composed of five organized bodies, inclosed within each other, and nourished by common viscera, placed in the center: what the bud of the tree is to the invisible buds it contains, such is the exterior part of the caterpillar, or larva, to the interior bodies it contains in its bosom. Four of these have the same essential substance, namely, that which is peculiar to the insect in its larva state: the fifth, is that of the pupa. The caterpillar is really the moth, crawling, eating, and spinning under the form of the worm; and the pupa is only the moth swathed up. These are not three selves, nor three persons, but, the same individual, who feels, sees, tastes, and acts by different organs, at different periods of its life, having sensations and wants at one time, which it has not at another. It, in short, becomes successively the inhabitant of two or three worlds: and how great is the diversity of its operations in these various abodes! * Let us also consider of what riches we should have been bereft, if the silk-worm had been born in its perfect state. But, all insects are not thus. Some are produced, such as they remain their whole

* Bonnet.

whole lives; others come forth enclosed in an egg; many assume various forms, that are more or less remote from that which constitutes their perfect state: lastly, some go through part of these transformations in the womb of the mother, and are born of an equal size with their parent. And as they differ in these points, so do they, as to the nidus of their generation. Some eggs are deposited in oak leaves, which produce the red gall; others in the poplar, willow, or juniper. Some on the backs of other insects. The gnats, the ephemera, the phryganea, the libellula, hover over the water all day, and drop their eggs, which are hatched in the water, and continue there all the time they are in the larva state. Solitary bees and wasps prepare an habitation for their little ones in the earth. The voracious spider carries its eggs on its back, in a little bag formed of its own silk.*

No spot, however remote or bad its situation, whether in the extremes of heat or cold, dryness or humidity, is without inhabitants; and those places which are the least accessible to the human species, possess, perhaps, the greatest abundance. There are countries, where the

* Adams.

the vital substance fermenting, as it were, into life by the heat of the sun, breaks forth precipitately from its matrix, and spreads with a kind of fury over the whole land. There are countries, where the earth is totally covered with reptiles, where the light is obscured with innumerable multitudes of winged insects. The confused cries of an immense assemblage of beings of different species, the lustre of their attire, as in the fulgora, or fire-fly, and their perpetual agitation, seem to have metamorphosed extensive forests into one animated mass. All warm climates abound in life. Even the bleak north sometimes pours out myriads, more destructive than the ancient ravages of the Roman world. Thus, the *grylus migratorius*, a few years since, passed out of Tartary in such quantities, as to lay waste great part of Europe, producing almost unequalled calamities. In Sweden the cattle perished with hunger, and the men were forced to abandon their country, and fly to the neighbouring regions. *

In Abyssinia, and the neighbouring countries, there exists a still more formidable enemy. This insect is called *zimb*, or *izalsalya*; it is larger than a bee, with wings of pure gauze; the

* Amænitates Academicæ.

the head is large, the upper jaw sharp, and furnished with a sharp pointed hair, about a quarter of an inch long; the lower jaw has two of these pointed hairs, and the three, joined into one pencil, make a resistance to a finger, nearly equal to that of a hog's bristle. As soon as this winged assassin appears, and his buzzing is heard, the cattle forsake their food, and run wildly about the plain till they die, worn out with fatigue, affright, and pain. The inhabitants of Melinda, down to Cape Gardefau, to Saba, and the south coast of the Red Sea, are obliged to put themselves in motion, and remove to the next sand, in the beginning of the rainy season. This is not a partial emigration: the inhabitants of all the countries from the mountains of Abyssinia northward, to the confluence of the Nile, and Astaboras, are once in a year obliged to change their abode, and seek protection in the sands of Beja. The elephant and rhinoceros, which by reason of their enormous bulk, and the vast quantity of food and water they daily need, cannot shift to desart and dry places, are obliged, in order to resist the zimb, to roll themselves in mud and mire, which, when dry, coats them over like armour. Of this insect the prophet Isaiah says, "And it shall come to pass in that day, that the Lord shall

shall hiss for the fly that is in the uttermost part of the rivers of Egypt, and for the bee, that is in the land of Assyria. And they shall come, and shall rest all of them in the desolate valleys, and in the holes of the rocks, and upon all thorns, and upon all bushes."* Yet, this insect, contemptible as it is in size, has invariably given law to the settlement of the country. It has reigned, and kept up a government of energy, for a greater series of years, than any human government upon earth. How long it was prior to Isaiah, we know not. From his days, however, to the investigation of Mr. Bruce, there passed at least 2,500 years. In the plagues brought on Pharaoh, it was by means of this insect that God said he would separate his people from the Egyptians. So powerful is the weakest instrument in the hands of the Almighty.†

In a single drop of water, what thousands of little animals have been found to exist! So small, indeed, have they been observed by the aid of the microscope, that from analogy it may be conjectured, there are organized beings, who can pass through the leaves of a plant with as much facility as a horse can pass through a meadow;

* Chap. vii. † Bruce.

meadow; who can crouch under the imperceptible filaments of a flower; and who can exist at the fountain of a snow-drop's juices. Among the ephemera, youth is in the morning, maturity at noon, old age in the evening, and death at night. If insects have histories, they are the stories of a little day; and yet contain, perhaps, as much as the natural memoirs of a human century. They must, indeed, have a chronology, and optics, different from ours. How our science vanishes, as we approach the elements of nature! * Since exceedingly small animals are discovered and seen by the microscope, we may reasonably judge, there are parts incomparably less yet, which escape all our senses, all the industry of man, and exceed even imagination itself. Since a mite walks along, it must have legs, and these legs necessarily must have joints. In order to move these joints, there must be muscles, nerves, and tendons; and in the nerves, fibres, such as we see in those of larger animals, or, at least, something equivalent to them. And if we could carry this consideration yet farther, and speak of the heart, blood, brain, and animal spirits, we should be at a loss, and forced to confess our imagination

* Saint Pierre.

tion unable to comprehend the extreme minuteness of the smallest parts in the system of a mite.*

Man cannot draw aside the veil of nature. Not all the efforts of all the philosophers that the world has ever produced, have ever been able to penetrate into the inscrutable arcanum. The enormous volumes of their study, have only shewn uncertainty more uncertain. Enlightened minds, indeed, may have approached to where the secrets of animation commence, but, there they have been obliged to stop. Vain is the search to arrive at first principles, vain is the attempt to gain an intimate knowledge of creation. Attend to the atmosphere, which is perhaps the mighty magazine in which nature has reposited her immense stores of the germs of diminutive beings, in whose species, manners, and variety of movements, there is every essential difference. Some are like eels; some move slow; others move fast; many even continually revolve like tops upon their axes, though this rotatory motion is attended with a progressive one.† But, the animalcula in water, are the smallest we can discover. For though animalcula equally minute may fly in the air, or

* Rohault. † Spallanzani.

creep upon the earth, it is scarcely possible to get a view of them; whereas, water being transparent, and confining the little creatures within it, we are enabled by applying a drop of it to our glasses, to discover with ease a great part of its contents. These little animals move in all directions with ease and rapidity; sometimes obliquely, sometimes straight forwards, at other times circularly; one while rolling and turning round, and then running backwards and forwards, through the whole dimensions of the drop, as if in sport; at other times, attacking with avidity the little heaps of matter they meet with in their way. One of the wonders of modern philosophy is, the bringing such beings to our acquaintance. A mite was formerly thought the limit of littleness; but, we are not now surprized to be told of animals many millions of times smaller than a mite: for there are some animalcula so small, that upon calculation, the whole earth is not found large enough to be a third proportional to the whale, as the whale is in comparison to these little animals. *

The human mind, indeed, justly prides itself on the astonishing progress it has made in the science

* Cyclopedia Britan.

science of optics. Yet insects, without the aid of art, are probably man's superiors. Newton's advances in the path of light and vision, may be ranked among the greatest acquisitions of human knowledge. Hence, what discoveries by the telescope; and what wonders by the microscope! Nor let us forget that these discoveries received their birth from the exertion of the mental faculties. But yet, the natural eyes of an insignificant insect, can probably seize hold on objects that escape the sight of man. The eyes of many appear to be cut into a multitude of little planes or facets, like the facets of a diamond, having, to the naked eye, the appearance of net-work. Each of these small facets is supposed to possess the powers and properties of an eye. Leuenhoek counted 3181 of these facets in the cornea of a beetle, and 8000 in those of a horse-fly! But, the eyes of insects are immoveable. These multiplied eyes, therefore, enable them to view surrounding objects. Such numerous inlets to sight, also, may increase their field of view, augment the intensity of the light, and be productive of other advantages, of which we have no conception.*

* Adams.

It is an exquisite pleasure thus to see the Creator of heaven and earth constantly working in all the parts of nature, and nature itself daily renewed by Creating Power. These are not the productions of mechanism and dead matter. The will of the Divine Being is incessantly operating, in restoring the succession of creatures, that same Will, or Power and Wisdom, which made the first of every species. In enquiring into the scheme of existence, as far as our intellects can reach; in admiring the variety of the contrivances, and the exactness of the execution, we may apply all that we know of geometry and calculation, till our little knowledge is lost amidst innumerable and incomprehensible diversities. The higher we rise, and the deeper we descend into the scale of animated nature, the more beautiful are our views, and the more extensive is our prospect. Each species is continued. The individuals were not, indeed, created lasting, like the sun and planets, and the other great bodies of the universe; but, the species is evidently designed to be as durable. Thus, as in the renewing of the year, when fruits, and herbs, and flowers are decayed and perished, they are continually succeeded by new productions; and this governing power of the Deity,

Deity, is only his creating power constantly repeated; so it is with respect to the races of animated beings. What an amazing structure of parts, fitted to strain the various particles that are imbibed; which can admit and percolate molecules of such various figures and sizes! Out of the same common earth what variety of beings;—a variety of which no human capacity can venture the calculation; and each differing from the rest in taste, colour, smell, and every other property! What is still more wonderful, how powerful must that art be, which makes the flesh of the various species of animals differ in all sensible qualities, and yet be formed by the separation of parts of the same common food! In all this, is the Creator every where present, and every where active: it is he who clothes the fields with green, and raises the trees of the forest; who brings up the lowing herds and bleating flocks; who guides the fishes of the sea, and wings the inhabitants of the air, the meanest insect, and reptile of the earth. He forms their bodies incomparable in their kind, and furnishes them with instincts still more admirable. Here is eternally living force, and omnipotent intelligence and direction.*

* Baxter.

The number and the variety of living creatures, appear to be greater than those of vegetables. A great naturalist at Paris, announced some years ago, that he possessed a collection of upwards of 30,000 different species. But, even this, if accurate, was trifling to what does exist upon the face of the globe. All nature seems to be but one mass of animation.* Buffon, indeed, says, there are not in the whole habitable earth above three hundred species of quadrupeds, even including forty different species of monkies, and fifteen hundred species of birds; out of which man has selected about twenty, which are more useful to him than all the others. But, life is infinite. Vitality seems the grand object of creation. The obvious law seems to be, that the sum of the different kinds of organized bodies, shall increase in proportion to the degrees of sensation and animation. Thus the living vegetable world leaves the unorganized mineral kingdom far behind; while this latter, again, is greatly exceeded by animal nature, which is obviously possessed of higher degrees of sensation. Of the mineral kingdom, not more than five hundred distinct kinds are yet known, if so many. Of the vegetable, not

* Saint Pierre.

not more, perhaps, than twenty-eight thousand. So that the proportion between the mineral and vegetable world, will be as one to fifty-six. It is true, the different species of animals with which we are as yet acquainted, are not supposed to exceed what is above said. But, this family is illimited. No part of the earth's surface, not a single production, not even mineral bodies, a few exceptions being admitted, are inaccessible to animals. Every plant possesses its own peculiar inhabitant; in some, several species are found. The superficies or skin of all animals, not excepting insects and worms, have their own peculiar insect; the intestines afford lodging to various worms; nor are any of the viscera totally exempt from them. The semen of animals abounds with them; and myriads are discovered by means of infusions. To these may be added the multitudinous products of the sea, which from not experiencing the same extremes of heat and cold with terrestrial beings, are as prolific under the pole, as under the equator. Land animals, if their situation be too hot or too cold, cannot so immediately change it for one of a more convenient temperature. Their course is interrupted by rivers, mountains, and seas. On the contrary, the in-

habitants of the ocean can instantly plunge fathoms deeper, if they should find the degree of heat or cold insupportable near the surface; or they can easily migrate from one country to another. The quantity of living substances upon the earth, and under the different zones, is proportioned to the degree of heat connected with that of moisture. The aqueous tribe, on the contrary, is universally disseminated, and hence the land may be looked upon as a mere desart, when compared with the ocean.*

But, the deduction of all terrestrial, as well as of all aquatic animals, from this very ocean, as I have already noticed, is an hypothesis to which I am certain you will not subscribe, however you may be staggered by almost general transformation. There are no land beings, say the fishy philosophers, whether walking, flying, or creeping, the similar species of which are not contained in the sea; and the passage of which from one element to another, is not only possible and probable, but, even supported by a prodigious number of examples. We do not speak merely of amphibious animals, say they, serpents, crocodiles, otters, various kinds of sea-calves, and a prodigious number of others, which

* Zimmerman.

which live equally in the sea and air, or partly in the water, and partly on the land, but, we also speak of those who can only live in the air. The resemblance in figure, for example, and even inclination, between certain fishes and some land animals, is astonishing. The animals produced by the sea, are of two kinds; the one volatile, which raises itself from the bottom to the surface of the waters, in which it swims, walks, and pursues its prey; the other creeps at the bottom, is not, excepting very rarely, separated from it, and has no disposition to swim. From the volatile fish, accordingly sprang birds; and from the creeping ones, quadrupeds, insects, and reptiles. In all men, likewise, there is an indelible mark that they drew their origin from the sea. By a microscope you can discover their skins covered with small scales, like a carp. Is it after this surprizing, that Thales, Anaxagoras, and others, should have asserted that water was the first principle of all things? The sea includes air, earth, and even fire. Thus she reunites every thing that can concur to the generation of all species capable of life, animality, or vegetation. Did not Venus spring from the froth of the sea?

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We are often told, that every man is capable of seeing truth, when fairly deduced; and that philosophy should be no mystery. I am very decidedly of this opinion. But, I must acknowledge, these long oceanic deductions, are greatly beyond the depth of common apprehension, even though, for instance, an example such as the following should be given, and should be supported with gravity and firmness. Why has the north been called the cradle of mankind? It has not assuredly been from the violence and usurpation of the Romans, which drove many wretched people and nations from more southerly countries, to seek an asylum in the north, and who, while the haughty republic continued in vigour, were forced to remain without any attempt for their restoration, but who, when she slackened in energy, seized upon the occasion, and rushed in those mighty and irresistable bodies, which she allured to be partakers of the spoils of the world. No:—it was because the first of the race of men came from the heart of the Northern ocean. There generated among whales, porpoises, and sea monsters, they soon multiplied to such an extent, that they were thrown at last in shoals upon the Northern coasts, like herrings and pilchards, and thence poured in torrents into a

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more genial southern climate. Whence we read in the old Litanies, "A furore Normanorum, libera nos, Domine."

Nature is a book always open; but, it is not always to be read without study; nor to be understood without nice discrimination. I do not mean that man should, in the very literal sense of the word, be a minute philosopher; for those who apply too much to little things, are too seldom capable of great things. But, I would have him observe, and I would have him think. To men, indeed, whose minds are chained to the earth, by the sordid pursuits of wealth, or the empty ones of ambition or, who are rendered torpid to every arduous exertion by habitual inactivity; to men of this complexion, every attempt to investigate the nature of this earth, or the history of its inhabitants, will appear a chimerical undertaking, originating in idle speculation, and terminating in useless conjecture.* But, the finger of God is visible in his works. How various the instinct, how various the passion of animated beings! Some live in tumultuous republics; others in profound solitude. Some pass their time in war; others in offices of love. Each has its pecu-

* Bishop Watson.

peculiar mode of offence and defence. The lion rushes upon his enemy. The torpedo strikes him with his invisible electricity. Yet, almost all, labour and rejoice for man. Every situation nourisheth for man an able servant. The horse on the plain; the cow in the valley; the sheep on the side of the hill; the goat on the top of the mountain. In the marsh, the hog delights to delve. Geese and ducks live upon aquatic herbs. The hen picks up the scattered remnants of the field. The bee labours amid flowers. All these creatures, with various others, after toiling through the day, come home again at night to the human habitation; and there, with bleeting, with murmurs, and with cries of joy, render to man the precious tributes of vegetation, transmuted by an inconceivable chymistry into milk, honey, eggs, wool, feathers and hair.*

The noxious species of animals are few in number. But, it is asked, if the destruction of animals be hurtful, is not man the most noxious and pernicious of animals? Does not he alone sacrifice more individuals, than the whole carnivorous tribes? The latter are hurtful, only, because they are rivals to man; because they have

* Saint Pierre.

have the same appetites, the same taste for animal food; and because, in obedience to this unavoidable desire, they sometimes dispute with him that prey, which he would engross for the gratification of his inordinate appetite; for man always sacrifices more to his intemperance, than to his real wants.* This is true; and we might even go still farther, and say, that so familiar, and, as it were, so natural to man, is the practice of violence of all sorts, that our indulgence allows the slightest provocation, the most disputable right, as a sufficient ground for natural hostility. Promiscuous multitudes of men, are almost savage beasts, alike destitute of humanity, and of the guidance of reason. Prejudice is blind, and hunger is deaf. The same effects are produced by the same passions, and where these are uncontrouled, small is the difference between the brute and the man. The god-like attribute, however, of commiserating the misfortunes, and assisting in lessening the distresses of others, appertains not to the brute in any sensible degree. This distinction marks strongly the difference between the human species and the animal. "Separat hoc nos, a grege mutorum." †

As

* Buffon. † Juvenal.

As to the destruction of animals, and the making them our food, one thing, indeed, seems certain, that the human race had probably peopled the greatest part of the earth, before agriculture was generally known. The origin of agriculture is unknown, and its establishment must proceed from the union of a great variety of circumstances, which are not in the power of every nation. Can any proof be more conclusive, that men were destined to feed upon the flesh of animals, and not merely upon the produce of the earth, than that hunting and fishing are the occupations of men in the savage state? Agriculture comes afterwards. But nothing authorizes, I will confess, wanton cruelty, and unnecessary destruction. A royal Nimrod in the southern part of Italy, as we have witnessed, amuses himself, as his relation does in Spain, with the murder of at least forty thousand living beings in the year. This does not speak much for philosophy, nor for the expansion of mental faculties. But, let us still go farther. The Hindoo, and some other Southern nations, live principally upon vegetables. I grant it. But, the inhabitants of Lapland can have little or no dependence on the fruits of the earth. They neither sow nor reap. They still remain, and

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from the nature of their climate must for ever remain, in the shepherd state. Where there can be no products from the ground, there man cannot be otherwise than carnivorous.

The temperature of animals is a subject of considerable curiosity. In animals with hot blood, we find a sensible temperature, superior to that of the atmosphere, which is also constant and permanent, though the surrounding medium, from its greater coolness, ought to absorb the difference, as happens in the case of other bodies. This phænomenon indicates a cause perpetually in action, and, from many considerations, leads to the belief that animal heat is generated in the lungs. The larger these are, the hotter are the animals. Hence birds exceed animals in this respect. Respiration is accelerated by a more violent motion than usual, and the heat is at the same time encreased; an effect to be ascribed to the quantity of air respired, and by no means to friction in a body full of liquids. Animals without lungs, have their temperature depending on that of the medium in which they live; to us, they feel cold: not to adduce any more proofs of the efficacy of the air. Priestley contends, that common air seems to carry off the superfluous phlogiston

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of the body. Crawford afterwards embraced the opinion, and has admirably illustrated the process. The specific heat of common air, is to that of the ærial acid, as sixty-nine to one; so that if these two fluids were to receive an addition of heat of one degree, the former would fix sixty-nine times more than the latter. Now, we know, from the observations made at Petersburgh, that the mercury may descend 111 degrees of the Swedish thermometer, below the mean temperature, the freezing point of mercury corresponding to the 40 degree below 0 of Farenheit's thermometer. Therefore, if the common air were to be changed into ærial acid, thirteen times more heat must be set free, than is necessary to turn iron red hot. Now, as common air is phlogisticated in the lungs, and converted into ærial acid, we may hence form some judgment of the quantity of heat which is set free by respiration, and may serve to warm the body. Besides, as the specific heat of the arterial blood is to that of the venous as 100 to 89, it is evident that phlogiston is gradually accumulated in the veins, and exonerated in the lungs, that the blood may be rendered capable of receiving the due specific heat. Experiment shews a greater specific heat in

in the arterial than in the venous blood. A great quantity of phlogiston seems to be requisite for the purposes of the animal œconomy at all times.*

But, man can bear variety and vicissitude of climate, better than other animals. We see, indeed, in the animal creation, as I formerly observed to you, that there are many prognostics, which, before we are sensible of it, give them notice of change. Brutes are in general good weather-glasses, or, more properly speaking, perhaps, good electrometers. They are more acute in certain of their feelings than we are. So long as the swallows fly aloft, we think ourselves secure of a serene sky. Dogs grow stupid and drowsy before rain. Water-fowl dive and wash themselves; and even the fishes in rivers are affected; for all fishermen tell us, they never bite so freely as when rain is approaching. Flies, on the contrary, are particularly troublesome, and seem to be more hungry than usual. But, in the bearing up against every extreme of climate, man indisputably manifests the superiority of his nature. It is not many years ago, since Lord Mulgrave, Sir Joseph Banks, Doctor Solander, and Doctor

* Bergman.

Blagden, bore an artificial heat of upwards of 250 degrees of Farenheit's thermometer, without feeling any alarming inconvenience. Dr. Blagden, even for eight minutes, supported a heat of 48 degrees greater intensity than that of boiling water, or 260 degrees. In France and Switzerland, female servants are often seen to enter into the enormous ovens which are sometimes used in those countries, and to continue in them minutes together, when the thermometer of Farenheit stands at above 275 degrees; that is, 15 degrees higher than that of Dr. Blagden. On the contrary, dogs have been found scarcely able to resist the 220 degrees. Tillet's bird, the loxia, died in the heat of 169 degrees. A rabbit bore tolerably well 164 degrees, but, a cock could not endure the same heat without danger. Man can likewise bear the most penetrating cold. Thus he can live, and continue healthy, under all the variations of temperature, from the lowest point of natural cold, to the highest point of natural heat. This universality of frame, indeed, exposes man to a great diversity of atmosphere. He breathes, and often continues without disease, in airs surcharged with watery particles, and laden with nox-

* Duttamel. Tillet.

noxious vapours. Many thousands pass their days in the mines of Potosi; and Condamine informs us, he found healthful inhabitants in a country between Loxa and Juen, where they were free from rains only two months in the year. Man is no less qualified by nature, to derive wholesome nourishment from whatever species of food he may find in each climate. Both his appetite and his make, prove him to be carnivorous, granivorous, frugivorous, and ichthyophagous. The Greenlander satiates his appetite with the raw flesh of the whale, and washes it down with the blood of the seal. The inhabitants of Jakuti feed luxuriously on mice, wolves, foxes, horses, &c. while the poor Lybian is contented with dried insects. Numberless sects of India feed on rice: while an European stomach can bear at one meal a compound of milk, soup, mineral water, oil, vinegar, mustard, beer, cyder, pepper, salt, bread, butter, cheese, various sorts of wine, butcher's meat, poultry, fish, vegetables, and fruits; and after all, a scarcely conceivable superstructure of tea, coffee, cream, sugar, cakes, and liqueurs. * It is true, indeed, if we have the capacity to contain this worse than

* Zimmerman.

Trojan boar, which even the Epicureans of Rome allowed to embrace within its womb so many hidden enemies; and the energy of organic functions to exist in health, with such astonishing repletion; so are there, on the contrary, animals, who exist for a considerable length of time even without any food whatever. But, this is in a state of torpidness. In this state, indeed, Buffon says, animals do not sleep during winter; but, that they rather have a stagnation of all their faculties: for this torpor, says he, is produced by the congelation of their blood, which is naturally the coldest of all quadrupeds. The usual heat of man, says he, and all other animals, is about fifty-six degrees above congelation, or ninety-eight degrees. The heat of these is not above nineteen or fifty-one degrees. So that when the thermometer sinks below the natural heat, the torpor commences: an encrease of heat, either natural or artificial, always reviving them. But, here the great French naturalist was probably incorrect. By what means torpor is produced in certain animals, is, it is true, uncertain; whether the fluids be rendered unfit for circulation; whether the nerves be deprived of their influence; or whether the muscular fibre be no longer susceptible

of

of that influence. But, this temporary cessation of life, is not owing to the refrigeration of the blood; nor is the temperature of those animals, in which it is manifested, equal to that of the atmosphere, and regulated by it. By repeated experiments, it has been found that the subjects of Buffon's hypothesis are not to be numbered among animals of cold blood. In the mouths of these animals, Spallanzani has seen the liquor of the thermometer rise to the 101st degree at a time, when out of the mouth, it stood at 35 degrees only. The cause, therefore, of this lethargy, is not connected with any condition of the blood; it seems to depend on the privation of the irritability of the muscular fibre. Spallanzani proved it on frogs, toads, and newts, whose hearts may be cut out, not only without immediately destroying them, but, without retarding the exercise of their functions, or impairing the vivacity of their movements. Taking advantage of this singular property, he totally evacuated their vessels. He then buried them in snow: the expected effect followed, and they soon became torpid. But, being re-exposed in this state to a proper temperature, (still without blood) the suspension of life was succeeded by a complete recovery of the use of their vital organs; insomuch, that there did

not appear to be any difference between those which had sustained the loss of their fluids, and those which were subjected to the experiment unhurt and entire.*

As we are accustomed to see all animals, with which we are acquainted, eat and drink, it appears to us difficult to conceive how any one can exist, in a state of sleep or torpor. But, if we recollect, that the necessity of nourishment which animals experience in their ordinary state, proceeds from a continual waste of their substance by perspiration, it will appear less incredible, that some animals in a torpid state, perspiring less, because they use no exercise, should have less need of aliment; and that others, which are covered with scales or shells, which stop perspiration, such as land and sea turtles, serpents, and some species of fish, should be able to subsist a considerable time without any nourishment whatever. A toad, it is said, will live buried in sand in this state, until the sand becomes petrified: and then being enclosed in the stone, it may still live for we know not what length of time. The facts, which are cited in support of this opinion, are too

* Spallanzani.

too numerous, and too circumstantial, not to deserve a certain degree of credit. A plant, with its flowers, fades and dies immediately, if exposed to the air, without having its roots immersed in a humid soil, from which it may draw a sufficient quantity of moisture to supply that which exhales from its substance, and is carried off continually by the air. Perhaps, however, if it were buried in quicksilver, it might preserve, for a considerable space of time, its vegetable life, its odour, and its colour. Flies have been preserved in a manner somewhat similar: some, for instance, says Franklin, drowned in Madeira wine, apparently about the time it was bottled in Virginia to be sent to England. At the opening of a bottle of this wine, continues he, at a friend's house in London, many months afterwards, three drowned flies fell into the first glass that was filled. Having heard it remarked, that drowned flies were capable of being revived by the rays of the sun, I proposed making the experiment. They were therefore exposed to the sun upon a sieve, which had been employed to strain them out of the wine. In less than three hours, two of them began by degrees to recover life. They commenced, by some convulsive motions in the thighs; and at length they raised themselves

upon their legs; wiped their eyes with their fore feet; beat and brushed their wings with their hind feet; and soon after began to fly.* The number of animals, likewise, that continue in a torpid state, during the severity of winter, is considerable. Among these, are the snail, the hedge-hog, the dormouse, the marmot, the toad, the frog, &c.

But, as man is guilty of a greater variety of excesses than the other animated beings, so is his health more feeble and precarious. He is oftener sick; his sickness is of longer duration; and he dies at every age. The brute, on the contrary, seems to run through the space allotted to his existence, with firm, and with equal steps. This circumstance appears to proceed from two causes. The first is, the agitation of mind, occasioned by the derangement of our internal sense. The passions have an influence on health, and introduce disorder into the vital principles. The majority of men lead either a timid, or contentious life, and most of them die of the effects of chagrin. The second is, the imperfection of our appetite. The brute animals distinguish better what is agreeable to their nature. They are never deceived

* Franklin.

ceived in the choice of their aliment; they never exceed in their pleasures: guided by the perception of their actual wants only, they remain satisfied, and never search for new sources of gratification. Intemperance alone is more fatal to man, than the united force of all the other evils incident to human nature.* But, we may say of both one and the other, that, "as the green leaves on a thick tree, some fall and some grow; so is the generation of flesh and blood; one cometh to an end, and another is born." †

Between the human species, and certain other tribes of beings, there is from necessity, it is natural to suppose, a constant disposition to hostility: yet it is from experience only, that birds learn to shun the approach of man. Whether this has existed in all times, it is impossible to determine. There may have been a period of amity. But, as we have no unallegorized record or tradition of that period, nor, from observation at the present moment, any instance of different animated beings herding together in the social bonds of friendship; so must we conclude, that the living creatures of this world are

* Buffon. † Ecclesiasticus.

are such as they always have been. Nor is this dissimilar to the clashing propensities, which are universally found, even among the human race themselves. Man, it is said, is never afraid of man, till he finds him to be a foe. But man (and we are not to conceal the calamitous truth) has much more to fear from the passions of his fellow-creatures, than from all the sanguinary fierceness of the rest of the creation, or from all the convulsions of the elements. The bloody fangs of the monsters of the desart, the mischievous effects of an earthquake, a deluge, a hurricane, or the eruption of a volcano, bear an inconsiderable proportion to the calamities of war; even as they are now moderated by the prudence or humanity of the princes of Europe, who amuse their own leisure, and exercise the courage of their subjects, in the practice of the extirpating art.* But, why should this be? I know not; any more than I do, why contrary to the generally received systematic laws of physics, which shews the retardation of the growth of the beard and hair of man in winter, and its acceleration in summer,—the cold should accelerate the growth of the fur of animals in the north; while towards the equator, the heat makes the fur fall

* Gibbon.

fall off, and the hair to grow as its substitute.

War, for aught I know, in these very effects which we regret, may be but one distemper more, by which the Author of nature has appointed our exit from human life. In all events I clearly perceive that man is not the only animal that makes war with his own species. Quadrupeds, birds, fishes, insects, independently of their appetite for food, occasionally fight and kill each other. Observe a hive of bees; look how the neuters cruelly massacre the males. If a strange bee by accident enters the hive, he is punished with death. Mortal combats are not unfrequently seen between two bees of the same community: even general actions are to be seen, especially in the swarming season. Throughout the whole of animated nature, rapine, and the destruction of individuals prevail. The cause is inscrutable. But, it probably is fact, that no animal does or can exist totally independent of food that is, or has been animated. Sheep, oxen, and all herbivorous animals, daily devour thousands of insects. Nature, in a word, is so profuse in her animated productions, that no food can be eaten, and no

fluid

fluid can be drunk, in which animal substances, either in a living, or a dead state, are not to be found.*

It is loss of time in man, to dive into what is decidedly beyond his reach. He, who was born yesterday, lives to day, and dies to morrow, cannot grasp the phænomena of the boundless circle of existence. The generation of some things, and their dissolution, is instantaneous. Others require ages for their configuration, and their subsequent decomposition. Some are integral; others are compound. The quadruped and the bird are distinct; yet the chain links by the bat. The human race and the quadruped are separate; yet the monkey tribe forms the connection. The amphibious animal leans to the fish: the polypus to the vegetable. The vegetable, again, to animated nature. The coraline, again, blends the whole: it appertains to the class of fossils, for it has a lapidific property which fixes it to rocks; it appertains to vegetables, for it has branches, ramifications, and flowers; it appertains to animals, for it has certain insects, which are its inhabitants, if not its fabricators, but, which, incapable of detaching

* Smellie.

ing themselves, die in the prosecution of their ingenious labour. In the universe at large, therefore, we see that all substances gravitate towards each other: in the ætherial spaces, the heavenly bodies; in the regions of the earth, the bodies of which the earth is composed. How this happens, we are yet to learn. At the same time, it is astonishing, as I have already remarked, we can transform, if not create, in a certain degree, animal and vegetable existence. The florist can variegate at pleasure his tulips; the botanist can have different fruits from the same tree; animals are even to be formed by mixture of breeds. Hence, who can venture to pronounce that nature has only one mode of generation? The sexual distinction of beings, is permanent. But, how numerous the tribe of hermaphrodites! Viviparous, as well as oviparous animals, are often seen to produce without the congress of the male and female. Flowers, that have but one sex, are more rare than those that re-unite the organs of both sexes, the stamina and pistils. By section, certain reptiles are to be propagated, but, the androgyni of the human race, whatever may be said of them, are certainly not common; nor are they solitarily prolific. The hermaphrodites of the villa Borghese, and of the gallery of Florence, may indis-

indisputably have had their archetypes in nature; but, in sound physics, they are no more to be considered than the centaur, or laocoon. A human body that can engender, and be engendered, has never yet been discovered. Roman depravity, indeed, at one time went so far, as to encourage the pursuit, and to delight in all the deformity of monstrous productions. *Gignuntur & utriusque sexus quos hermaphroditas vocamus, olim andraginos vocatos; & in prodigiis habitos, nunc vero in deliciis.**

In the comparative judgment, which we pass, on the different orders of the creation, we call those beings intelligent, which are organized like ourselves; in whom we see faculties proper for their preservation, for maintaining them in their allotted situation; and who have an evident consciousness of their own individual motions. Those, again, we regard as not intelligent, whom we do not find conformed like ourselves, neither having the same faculties, the same organs; in a word, in whom we know neither the essence, the energy, nor the end, and who are apparently in ignorance of their particular appropriation. An intelligent being, consequently, must be a being who thinks, who wills,

* Plin. Hist. Nat. Lib. viii. Cap. 1.

wills, who acts to arrive at a certain end. Thus, man feeling himself incapable of producing those vast and multiplied effects, which he yet sees operated in the universe, is naturally led to fix some distant analogy between his own faculties and that invisible Cause which produced them; leaving the mass of nature which is visible to him, as the inert substance, which is, at all proper moments, moulded into existence by the plastic hand of the Divinity. But, it is said, nature producing and possessing intelligent beings, must be herself intelligent. Every thing has its peculiar sensations, and why should not the globe itself? By what extravagance is it, we are asked, that we conceive existence to be derived from an inanimated body? How, shall we say that nature, who has made every thing for us insects, should be herself neglected, and classed contemptibly together with the other celestial spheres? Shall a snail have existence, and shall the sun be considered as dead?*

The notion, that this globe is an animal, is curious. Analogy may go a great way. In various appearances, the parallel is closely to be run. How easy is it to suppose the earth moving in the liquid regions of space, as the leviathan

* Robinet,

leviathan of the deep swims in the waters; or the bird of the air floats in the atmosphere! Pythagoras, in some instances, we know, divided the soul into two parts, the rational and irrational; but, generally into three, for the irrational he divided into irascible and desiderative. These he termed Νᾶς, Φρὴν, Θυμὸς. The first and the last are in all living creatures; Φρὴν, only in man.* Yet, the souls of all animated creatures, he said, were rational, even those which we term little better than vegetable: but, they did not act according to reason, and were in consequence unfurnished with the faculty of speech. The Pythagoreans likewise believed in the soul of the universe, not as a simple, but as a compound being. The superior, said they, governs the inferior part. The whole forms a perfect animal. The Supreme Intelligence Νᾶς is the first; the living or sensible soul ψυχὴ is the second; the organized body is the third. This universe, therefore, is an animal, full of life and perception.

Considered abstractedly, this opinion of the first philosophers, of the universal soul of nature, was rather sublime than injudicious. It merely supposed a chain between God and nature,

* Diogenes Laertius.

ture, which was upheld by imperceptible gradations. From the Divine Nature, that descended to man; from man to the animal, who has evident marks of intellect; from the animal to the vegetable, which has irritability and sensations, and the undoubted distinctions of sex; from the vegetable to the fossil of organization; and from the fossil to the brute matter, out of which the most considerable parts of all the others are formed. This hypothesis was not unphilosophical. There is nothing contemptible in the idea, which binds each part of existence to its great Creator. The omniscience and omnipotence of God, are not degraded by allowing the different orders of creation those attributes which he has been pleased to confer upon them. Man being ignorant of the true system of beings, the basis of such reasoning was laid in wisdom. It is not, indeed, pretended by it, that the intellectual faculty of man partakes absolutely of the intellect of the Divinity. But, that which lives, must feel; that which feels must have ideas; and that which has ideas, must have an appropriated reason. A certain degree of soul, therefore, was readily to be supposed to circulate through creation: nor was such a doctrine to be accused of absurdity, even as it regarded quadrupeds, and other inferior animated beings.

Matter does not think: where there is sensation, therefore, there must be some species of mind. We even daily see, that the reason of animals is to be improved, and their ideas to be multiplied, like those of men, by the means of education. Does not this prove a certain, though, perhaps, a distant analogy, between the intelligence of the scholar and the intelligence of the master? But what shall become, it is asked, of the immaterial spirit of these animals at their final dissolution? Are we to give it immortality? I have already said, No. Shall we annihilate it? There is no such thing as annihilation. What then shall we do with it? I know not; nor am I ashamed to own my ignorance.

Animated nature, says Diderot, has had its peculiar elements from all eternity: these elements have been scattered and confused in the great mass of matter. They have, however, at various times, and in various manners, reunited, and formed embryos of various organizations; and these organizations have successively exhibited reflection, consciousness, thought, sentiments, feeling, signs, articulations, gestures, and simple sensations. Thus successively, the spirit of the world has been in a fly, a mouse, a dog,

a dog, a horse, a cat, an eagle, a salmon, a goose, an elephant. The elements of the ass to-day, may be the elements of the philosopher to-morrow. In short, all moral and physical associations, all learning, all science, the utmost extent of the human intellect, hath equally been the property of the hog and the goat, as of the arrogant, but not superiorly gifted animal, man.—But, the genuine doctrine of the metempsychosis, or the transmigration of souls, has been strangely obscured. It is commonly averred, that Pythagoras was of opinion, the souls of men after death, informed the bodies of beasts. But this surely cannot be seriously asserted of an enlightened man, of such extraordinary abilities as Pythagoras. The idea of this trans-animation, seems rather to have been raised by such as were partly ignorant, or partly envious, of his true doctrine. Perversion has ascribed to the philosopher, what never belonged to him. The cause of the error, however, probably originated from this: the ancients called the inclinations and wills of men, their minds; whence, such as were of one study, intention, inclination, motion, and sense, were termed unanimous. Thus the ancient philosophers called the motive and sensitive faculty, the soul. Whoever, therefore, were alike af-

fected, and moved by the same object, were said to have the same soul. The metempsychosis then, was nothing else, but equal care, motion, and study of some dead person, appearing in some living person. Thus Pythagoras might have arrogated the soul of *Euphorbus* and others, as having an inclination to the several excellencies which were in those persons. Again, in saying he was Euphorbus, he enigmatically taught (not the transmigration of souls) but the transmutation of bodies out of first matter; which is not only susceptible, but covetous of all forms, continually desiring, never satisfied with any; as if a comedy, to use the illustration of Aristotle, should say, I was first a tragedy, because both tragedy and comedy are formed of the same letters and elements.

The metempsychosis, in its origin, was a pure philosophical idea. The hypothesis of a transmigration of souls, does not arise from the simple review of the bodies by which we are surrounded. On the contrary, as death, positive material extinction, seems particularly the lot of animated beings, much reflection, and deep observation, gave it birth. No part of nature, dies to the philosopher. The whole is actu-

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ated by a living principle. From dissolution, proceeds generation; a chain of existencies forms the terrestrial system. Animals and vegetables, circulate and support each other. Thus, as nothing falls into annihilation, and as animals produce vegetables, and vegetables animals, so might the circulation of the immaterial part be rationally adopted by the Pythagoreans. And hence even the giving intelligence to trees, rivers, and fountains. Man is naturally inclined to bring every thing into comparison with himself; even to his God, he has in frequent instances given a corporeal frame. But, if the Pythagoreans were wrong, (not to say any thing of the transmigrating spirit of the Lama of Tartary), what shall we say of the transanimation of the infallible Pope, and the infallible Conclave of to-day, from the infallible Pope and the infallible Conclave of yesterday? Understood in the most liberal sense, are these modern Holy Personages any thing more, or less, than Hierarchical Pythagoreans? Pythagoras was Euphorbus; Pius, is Peter.

And now for one or two concluding miscellaneous ideas. The sense of property is not confined to the human species. The beavers

perceive the timber they have stored up for food, to be their property; and the bees seem to have the same perception, with respect to the winter's provision of honey. Sheep know when they are in a trespass, and run to their own pasture on the first glimpse of a man. Monkies do the same, when detected in robbing an orchard. The cow species has a sense of property, with respect to their resting place or inclosure. And he must be a sceptic, indeed, who denies that perception to rooks: there are thieves among them, as among men; but if a rook purloin a stick from a neighbour's nest, a council is held, much chattering ensues, and the *lex talionis* is applied, by demolishing the nest of the criminal. I have already mentioned to you, the well regulated societies of the beaver. That of other inferior animated beings, is not less remarkable. The habitation where moles deposit their young, is constructed with peculiar intelligence. They pair like beavers, and so lively and reciprocal an attachment subsists between them, that they seem to disrelish all company. The nidification of birds has at all times called forth the admiration of mankind. The skill with which their nests are constructed, and the uniform proportion of dimensions to the number and size of the young to be produced,

ced, are instances of extraordinary intelligence. The habitations of insects, are executed frequently by the labour of associated numbers. Bees strike us with astonishment, as do also wasps, whether we consider the solitary or the social species. Nothing can exceed them in sagacity, and laborious industry. What skill and dexterity are displayed in the construction of the combs of honey bees! Here are distinct cells for the accumulation and preservation of honey; there for the reception of eggs. Here the queen bee takes up her abode; there the drones or males inhabit; and here the working bees, whose tenements exceed those in which the males are lodged. Look at their whole town, how extremely populous, how crowded the streets, and yet how perfectly clean, well built, and architecturally uniform. Observe that bustling female, see with what rapidity she runs along the cells of the comb, distributing to each worm a portion of nourishment.* Nor are the habitations and the œconomy of the ant, less curious. What are we to say of the stupendous edifices of the *termites?* I have measured one myself which stood among many hundreds, and found it thirteen feet high, and fifteen feet in circumference at the base. Are

* Du Hamel. Reaumur.

the pyramidal wonders of Egypt to be compared to the structures of this little people? No buildings upon earth have ever been so complicated in their construction, nor any apartments so convenient in their distribution. What wisdom, what energy likewise, in the regulations of this unequalled race of inferior beings! Their history, is the history of wonders.*

We have had many occasions to mention the migrating principle of animated beings. Such however, is not confined to men, quadrupeds, birds, and reptiles: it extends also to many of the insect tribes. Numberless inhabitants of the air pass the first stages of their existence in the waters, and the intermediate ones in the earth. Similar migrations are to be observed among land insects. Indeed, if we except bees, wasps, ants, and a few others, most insects, whether they inhabit the earth, the air, or the water, are perfect wanderers, having no fixed place of residence. And some of these have, in ancient times, afforded such direful presages, as to terrify nations. Such for instance, was the supernatural falling of showers of blood, which in fact, was nothing more than

* Smeathman.

than the sanguinary drops which always attend the transformation of the crysalis to the butterfly.* The growth of certain insects is likewise prodigious. Some have been observed, in the space of four and twenty hours after their escaping from the eggs of the common flesh fly to their maggot state, to have increased 210 times in their weight.† But the increase of the queen of the termites, when the season of propagation arrives, is still more extraordinary. The abdomen of this female then begins to extend and enlarge, and in a short time, gets to be fifteen hundred, or two thousand times the bulk of the rest of her body.

In the enumeration of the animated classes of the ocean, I omitted the kraken, and the sea-snake, as well as the mer-man, and the mermaid, because doubts still hang on some philosophers' minds, relative to their existence. But I confess, I see no reason why we should suppose Pontoppidan credulous, or impair his honest fame, by calling him an exaggerator; or why we should deny existence to beings, merely on account of their bulk, or because we are not personally acquainted with them. The

* De Peirese. † Redi.

The supposed dimensions of the kraken are certainly enormous; and so is the length of the sea-snake. But have not some very enormous land animals at one time or other existed, though none but fossil remains of them are now to be found on the face of the earth? And is not the worm called *tænia*, comparatively speaking, almost of an equal length with the sea-snake? The mer-man, and the mermaid, are, however, not quite so doubtful. They come in as it were, to fill up the general analogies of animation, and like the monkey, are assimilated to the human species.

LET-

LETTER LIX.

WE now come to the consideration of a most beautiful family of nature, the vegetable kingdom. Not only the plains, and the valleys, we shall now behold delicately clothed, but the wild mountains, also, will appear in their rough, but grand attire. Vegetation and animal life keep pace together. Every soil and different climate have their peculiar species. Every season of the year brings forth variety. The diversity of the several species is astonishing: the fecundity of the individuals perhaps more so. But in all this the Almighty Author of proportion preserves an equal balance. In exuberance, he shews his power; in application, his wisdom and goodness. The analogy between vegetables and animals, is great. Vegetables, like animals, have a vital principle, and something like perception and knowledge. As quadrupeds, and other inferior animals, they propagate their species at the season allotted to them. They search with their roots, as with fingers, and thus feed themselves with that which

which they can select the most nutritious to their natures. If of a delicate texture, how pertinaciously do they stretch out their slender arms, and attach themselves to more sturdy stems! When parched with thirst, some of them will elongate their fruit, so as to touch any water that lies very near. Those of distinct sexes, delight in each others company. They often are together; and not unfrequently clasped in each others arms. When the evening damps begin to fall, many shut their leaves, and give themselves to repose. Others shrink at a rude hand, and instantly droop if they are contaminated by a touch. In the cold, bleak season of the year, the germ of vegetation, though apparently dead, is still forming in the matrix of its parent. In the spring, it is brought forth; in the summer, it flourishes; in the autumn, it ripens and circulates its precious fruit; and in the winter, unless its lot be spun out, it again disposes itself to another generation. Does not the animal, in like manner, pass a certain time in the womb of its mother? Does it not come into the world, at its appropriated spring; grow and flourish during its allotted summer? In its autumn, when arrived at maturity, does it not give forth its fruit for the good and the succession of its species? And

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in the winter, does it not shrink into itself, fall, and return to its simple material elements?

A vegetable is a living being, which grows and dies of age; and, like an animal, has occasion to take nourishment, to digest its aliments, and to throw off by excretions, what is superfluous and hurtful. The juices, which it evidently chuses and selects, are introduced on account of its want of a loco-motive power, by its roots or syphons. In the depth of winter, and while in a lethargic state or torpor, as various animals, it yet constantly yields a certain degree of warmth.* When the heats of summer begin, it springs from its somnolency; assumes a new life; employs itself in the propagation of its kind; absorbs the bad air, arising from animal respiration, perspiration, and final dissolution, and returns it in regenerated purity. In its emanations, the leaves exhale the vital air; the flowers, the phlogisticated air; and the bark, the common air. Are not the same phænomena observable in animals? The different organs of our bodies elaborate different juices: the surface in all its parts, does not afford the same emanations. The evaporation from our bodies, is different from the air we give in respiration; and from the inflammable air which issues

* Hunter.

issues from the intestines. Were air visible, we might probably be convinced, that vegetable is like animal respiration; that the organs of that function are the leaves; that these leaves are a sort of lungs, which have absorbent pores, and other excretories, like those of animals; and that the absorbent vessels are in the superior surface of plants, of trees in particular, and the excretories in the inferior surface. The bodies of animals, as well as of vegetables, are filled with air. In an exhausted receiver, and consequently freed from the action of the atmosphere, how similar are the effects derived from them!*

In the analyzation of a plant, the whole, or the greatest part of it, is an aerial fluid, transmuted into another body. The same is the substance of an animal, only that the fluid is more condensed: and this was the opinion even of some wise men of antiquity.† All terrestrial phænomena, are in a great measure owing to an aerial conversion, and reconversion. If it were not for these, says Lucretius, we should find but one, and one only substance in the world: *omnia jam resoluta forent, & in aëra versa.* The composition and decomposition of water, are

* Ingenhousz. † Epicurus- Lucretius.

are strongly in favour of this opinion. I do not mean the transmutation of water into earth, as supposed by Van Helmont and Boyle; the latter of whom had even conceived from experiment, that he had derived eighteen parts of earth from twenty parts of water. I mean the composition of airs into waters: and the decomposition of waters into airs. But plants and animals can only thrive, I might say, can only live, in the same specific kinds of air, the atmospheric, and the dephlogisticated; for highly phlogisticated air, or the aerial acid or fixed air, are both of them incapable of preserving the lives of animals or vegetables; notwithstanding the latter can do better with mephitic air than the former. Both one and the other, indeed, imbibe a phlogisticated fluid from the atmosphere. But the life of each is most vigorous in dephlogisticated air. In the obscurity of the night, plants as animals repose themselves. They regain in sleep, what they have lost in the exercise of the day. The end of this sleep is, *ut quiete tranquillâ fruentes, novas quasi vires recuperent.* * Their variety of mode in sleeping, is likewise remarkable. Some animals we know sleep lying; others kneeling; some hanging; others erect: so the plants of the genus

* Linnæus.

genus *Folüs pinnatis*, sleep by letting their leaves fall. Vegetables in general, as animals, without nocturnal repose, would waste and perish. But some of them, as some animals, sleep during the day, and wake during the night. *The cactus grandiflorus*, opens its flowers on the setting of the sun, and closes them on the breaking of the day. The *mirabilis jalapa* never opens its flowers but in the evening. Some flowers, even when asleep, hang their mouths towards the earth, to prevent the noxious effects of rain or dew. And this sleep of plants, is owing to a peculiar law prescribed to their species; and not to a quicker or a slower motion of their juices. Both animals and plants, likewise, growing from seed, they both are screened from the external air, and kept from the external light, until their thorough formation. When their organs are fit to bear the rencontre, they then burst into the world.*

The most perfect vegetables, as the most perfect animals, are progapated by the conjugal alliance of male and female: the less perfect vegetables, as the less perfect animals, for instance the zoophytes, by a solitary extrusion, or artificially by cuts and slips. There are

mules

* Ingenhousz.

mules likewise in the vegetable as in the animal kingdom; but the race cannot be kept up by descent, in the one more than in the other. Vegetables, at the top of the scale, have roots, branches, flowers, leaves, and all the other attributes of fructification. Animals, at the top of the scale, have all the faculties and attributes, essential to animality. Vegetables, at the bottom of the scale, have neither roots nor attributes of fructification: animals, at the bottom of the scale, have neither faculties nor attributes, generally supposed necessary to animality. In neither the one nor the other, as in *mosses* and *polypi*, is there sex or seed; at least it was so believed until Linnæus discovered the *propago*, or seed of the moss. Birth, growth, disease and death, are the lot of one as well as the other. Even in regard to circulation, the analogy is astonishing between the polypus, the tœnia, and various shell fish, which have not the smallest appearance of circulation, and the moss, which is in the same predicament.* But is not an animal, in its first state, in every respect a vegetable? And is not the umbilical chord, the root or syphon for the food of the plant, either in the egg or in the matrix? Loco-motion, sensation, irritability, are said to be qualities

 essential

* Bonnet.

essential to animals. But are there not animals without these qualities; and are there not vegetables with them? The *noli me tangere*, by the vivacity of its sensations, is assuredly as much intitled to be called an animal, as the marine zoophyte, which only stretches its arms.

Neither is the form or structure of the imaginary model we give to animation, exclusively confined to animation. We distinguish animals and vegetables, as the ancients did, by the words *vegetare*, to push, and *anima*, soul or mind. But, does not man grow as a plant? Does not the polypus, by extrusion, propagate its likeness, and in such a way that great grand-mother, grand-mother, mother and child, shall all hold together in one mass, and be as it were one integral substance? Has the muscle or the barnacle, a mind? Does not all this lead to the contemplation of the two kingdoms, which have been hitherto kept distinct, as nearly one and the same? Animality offers a vast field of observation; for besides what we have already noticed, there are animals which have neither flesh nor blood, and who appear to be nothing but a mass of jelly, as the *Medusa*; who cannot search for their nourishment even as vegetables, but who are indebted for

for it to the administration of the element they inhabit; who have apparently no sense, not even that of touch or feeling; and who are unfurnished with any discriminating sex. How is animality then to be clearly identified in contradistinction to vegetability? Decomposition proves these substances nearly the same. Whatever naturalists may have therefore said, there is no admitting the universality of the sexual distinction, even in animals; nor is there any possibility of ascertaining the point, where the animal chain terminates, and where the vegetable chain begins. One thing, indeed, seems clear, and that is, that no circulation can be carried on without a living principle.

Vegetables are distinguished into trees, shrubs, herbs, flowers, grasses, mosses, &c. They are likewise distinguished by the soil they delight in, as the dry or the humid: some growing in sand, gravel, and on the surface of rocks; others in clay, marshes, water, and even on other vegetables; by their odour, savour, and colour; by their consistency, and by their duration. Considered externally, they are formed of six organs; the root, the trunk, the leaf, the flower, the fruit, and the seed. The root sucks up juices for the trunk, which is the

main prop, and whose bark is an *epidermis* of a vascular consistency. The leaf absorbs the phlogisticated air, and exhales the dephlogisticated air. The flower is the part destined to contain the organs of generation, and to protect them till fecundation is accomplished. Then they fall. The fruit is the product, or result of the flower; or that, for the production and nutrition of which the flower was intended. The seed is the matter prepared by nature, for the reproduction and conservation of the species. It frequently is the fruit of the plant; sometimes it is only inclosed in the fruit. This little seed contains the minute germ or bud, which composes the prime, and most noble part of the whole, but which, according to calculation, hardly makes the thousandth part of its volume. Yet, it is in this, that the image and representation of the whole tree is perfectly delineated and expressed; and this principal part, being any way spoiled, hurt, or decayed, the seed, however large and otherwise perfect, will come to nothing, but will rot in the earth. The whole plant is enveloped in the seed. *

The perpetuity and safety of the species, depending upon the conservation of the seed, nature

* Necker.

ture hath taken particular care of it, especially in such as dare to shew their heads all the year. How securely is the flower, seed, or fruit, locked up during the winter, together with the leaves and branches in the germ, and well fenced and covered with a close and impervious tunic. For those who dare not so expose themselves, with what safety are they preserved under the coverture of the earth, in their root, seed, or fruit, till invited out by the kindly warmth of the spring! And when the whole vegetable race is thus called out, it is curious to observe the methods by which they guard against harms and inconveniences. Some lie down prostrate; others close themselves up; some shut up their flowers, their down, or other like guard, upon the close or cool of the evening, for fear of rain, or other matters that might be prejudicial to their tender embryo. How various, likewise, the ways of sowing their seed: some are winged with light down or feathers, to be conveyed about by the winds: others are laid in elastic springy cases, which, when they burst and crack, dart their seed at convenient distances, performing thereby the part of good husbandmen. Others, by their agreeable taste and smell, invite themselves to be swallowed and carried about by birds, and thereby also to

be fertilized by passing through animal bodies; and others, not thus taken care of, do many of them, by their utility to mankind, encourage nursing and cultivation. The vegetative spark, the ultimate produce, yet incipient principle, will remain in seed for an astonishing number of years.*

Plants consist of different parts, vessels, &c. analogous to those of animals; and each kind of vessel is supposed to be the vehicle of a different humour or juice, secreted from the mass of the sap. The other external appearances, however, or the parts for instance, of which a complete flower consist, are the *calyx*, empalement, or flower cup. It is the termination of the cortex, or outer bark of the plant; which, after accompanying the trunk or stem through all its branches, breaks out with the flower, and is purest in the fructification in this new form. Its chief use, is to enclose and protect the other parts. It has received different appellations, according to the circumstances with which it is attended, such as *perianthium*, *involucrum*, &c. &c. The calyx always withers when the fruit is ripe; sometimes before it is so. It is in many flowers deciduous, dropping off

* Agricola.

off the instant the flower begins to expand. The *corolla*, foliation, is commonly called the leaves of the flower. The corolla is the termination of the *liber*, or inner bark, continued to, and accompanying the fructification, in this new form of painted leaves. Its use is the same as that of the calyx, serving as an inner work of defence for the parts it encloses, as the calyx, which is usually of stronger texture, does for an outer one. The leaves of which the corolla consists, are called petals; by which appellation they are conveniently distinguished from the green leaves of the plants, with which they might otherwise be confounded. The corolla is sometimes monopetalous, or of one petal, and sometimes polypetalous, or of many petals. The *stamina*, threads, are commonly called the chives. The stamina are the male part of the flower. Linnæus defines them as an organ of the plant, designed for the preparation of the pollen. Each stamen consists of two parts, the filamentum, filament or thread; which serves to elevate the anthera or summit, and at the same time connects it with the flower; and the anthera, the summit itself, which contains within it the pollen, and when come to maturity, discharges it. Such flowers as want the stamina, are called female; such as have it, but want

the female part, are called male; such as have them both, hermaphrodites; and such as have neither, neuter. Besides these, there is the class polygamia, which either on the same, or on different roots, bear hermaphrodite flowers; and flowers of either, or of both sexes. The *pistillum*, is the female part of the flower. It is defined an organ of the plant, designed for the reception of the pollen. It consists of three parts; the germen, which is the rudiment of the fruit accompanying the flower, but not yet arrived at maturity; the style, which is the part that serves to elevate the stigma from the germen; and the stigma, which is the summit of the pistillum, and covered with a moisture for the breaking of the pollen, which is discharged by the antheræ. The *pericarpium*, seed vessel, is the germen grown to maturity. It is defined, an organ of the plant big with seeds, which it discharges when ripe. It is distinguished, according to the circumstances that attend it, such as capsula or capsule, which is a hollow pericarpium; legumen, a pod; pomum, a fleshy pericarpium; bacca, a berry, &c. The *semina*, or seeds, according to Linnæus, are a deciduous part of the vegetable; the rudiment of a new one, quickened for vegetation by the sprinkling of the pollen. The *receptacle*, is the base

base on which the fructification is seated. It connects the other six parts of fructification. The four first of these, are properly parts of the flower; the three last, parts of the fruit. Every vegetable is furnished with flowers and fruit; there being no species in which these are wanting. Flowers have from one to twenty husbands, and hence the terms, monandria, diandria, &c. &c. Some have even more stamina, and hence polyandria.*

On the number and the respective position of the stamina, and their pistils, Linnæus founded his sexual system. Much the greater part of plants, indeed, have hermaphrodite flowers; but there are abundance which have both the male and female flowers, growing from the same root, such are maize, or Indian corn; nettles, box, elm, birch, oak, walnut, beech, hazel, hornbeam, the plane tree, pine, fir, cypress, cedar, the larch, melons, cucumbers, gourds, and several others. In many of these, however, though the farina fœcundans, which providence, on account of its being liable to be spoiled by rain, or dissipated by winds, has provided in great abundance, is conveyed to the female by means of the atmosphere. The gardener, indeed,

* Lee's Botany.

deed, can convey it if necessary for a trial, particularly from cucumbers and melons, and exactly in the same manner as mentioned by Theophrastus, two thousand years ago, in regard to the palm tree. He has nothing to do, but to collect the male flowers when fully blown, and presenting them to the female ones, give them a stroke with his finger: the farina fœcundans will in consequence of the blow, be scattered into the parts ready to receive it, and the impregnation be completed. There are other trees again, which produce those necessary organs upon different roots. In the number of these, are the palm tree, hops, the willow tree, misletoe, spinach, hemp, poplar, the yew tree, juniper, &c.

Internally considered, vegetables offer five kinds of vessels or organs. 1. The common vessels destined to carry up the sap, are placed in the centre, in which it first mounts up perpendicularly, as if by capillary attraction. 2. The proper vessels for disseminating the juices: these are placed immediately under the bark, and appear to be excretory canals. 3. The pipes of the leaves, or lungs, which circulate the air they receive from the atmosphere. 4. The ducts,

ducts, formed like small bladders, or folliculi, which contain the marrow, and which are placed in the middle of the trunk, and which, like the brain and spinal marrow, if destroyed, all further power of vegetation ceases. And 5. The vascular tissue, which answers to the cellular or membranous tissue of animals.* The sap of plants may be considered as a most heterogeneous substance, consisting of water, oil, salts, sulphur, resins, gums, and juices of a thousand different combinations; which sap, when the leaves begin to appear, begins likewise to shew itself in circulation, increasing with the leaves, and circulating strongly while the leaves are in vigor, but declining, and at last ceasing, when the leaves fade and fall off. This sap is considered as the blood, or common fund of the vegetable system. The vessels have been styled, lymphæducts, lactiferous, resiniferous, &c. These vessels are the principal viscera of plants, and Grew says, as the viscera of animals are but such vessels conglomerated, so the vessels of a plant are viscera drawn out at full length. Bonnet has observed the vegetable sap to move three inches in an hour. It would seem, as if it were affected as quicksilver, by the degrees of heat and cold.

The

* Fourcroy.

The process of nature, in the vegetation of plants, is thus explained. The egg, or seed of the plant, being excluded out of the ovary called pod, or husk, and requiring further fostering and brooding, is committed to the earth; who, in her fertile bosom, not only does the office of incubation, by her own warm vapours and exhalation, joined with the heat of the sun, but by degrees, supplies what the seed requires for its further growth; as abounding every where with canals and sinuses, wherein the dew, exhalation, and rain water, impregnated with fertile salts, glide like the chyle and blood in the arteries, &c. of animals. This moisture, meeting with a new deposited seed, is percolated or strained through the pores or pipes of the outer rind or husk, corresponding to the secundines of fœtuses, on the inside whereof lies one or more, commonly two thick seminal leaves, answering to the placenta in women, and the cotyledons in brutes. These seed leaves consist of a great number of vesiculæ, or small bladders, with a tube corresponding to the navel string in animals. Into these vesiculæ is received the moisture of the earth, strained through the rind of the seed; which makes a slight fermentation, with its own immediate proper juice. This fermented liquor is conveyed by

by the umbilical vessel to the trunk of the little plant; and to the germ or bud; upon which a vegetation and increase of parts succeeds.

Every organized part of a plant contains in it a number of invisible seminal principles, capable of producing plants like that to which they have owed their origin. The graft of a tree, which from only one single bud, produces a tree like that from which it was taken, certainly acts upon this principle; for the whole tree is quite different from the stock on which it is grafted, which serves for no other purpose than merely to convey to it a proper nutritive juice for the developing its parts. Many roots, being cut into slices, will each propagate its species, and send up new plants, like that to which the root belonged. The vegetative principle is differently seated in different plants: generally speaking, its place is supposed to be exactly between the trunk and the root; at least, this appears to be the place in most of the seminiferous tribe, which, if cut down near that place, rarely shoot again. In other plants, as the potatoe, and many edible vegetables, it seems to reside wholly in the roots, which if cut into ever so many parts, yet those being planted in the ground, soon grow.

In

In others, as in the willow kinds, it seems to be diffused all over, both root, trunk and branches; insomuch, that if cut into a thousand pieces, there is no destroying them without splitting them in the middle, and scarcely then. Lastly, in others, as the cereus's, ficus's, &c. it is seated in the body, branches, and leaves, any of which, being put into the ground, strike root immediately. Among the thick and fleshy leaved plants, as the opuntia, and other of the succulent plants of India, there needs no more to produce a new plant, than to cut off a part of a leaf, and stick it into the earth, where it will produce a new plant, in a very short space of time.

It is inconceivable how one uniform, apparently homogeneous matter, having its principles, or original parts, of the same substance, constitution, magnitude, figure, and gravity, should constitute bodies so unlike in all those respects, as vegetables of different kinds are; nay, as the different parts of the same vegetable: that one should carry a resinous, another a milky, one a yellow, another a red juice in its veins; one afford a fragrant, another an offensive smell; one be sweet to the taste, another acid, bitter, acerb, austere, &c. that one

one should be nourishing, another poisonous; one purgative, another astringent; and all this from a body composed of water, and a certain peculiar terrestrial matter. It was long the opinion, that this terrestrial matter, or vegetable earth, was of a peculiar nature, specifically different from every other; but late experiments have shewn, that vegetables contain a very small proportion of earth of any sort, and that far the greater part of their substance, consists of water, fixed air, inflammable air in a concrete state, a small proportion of fixed alkali which probably is neutralized by vegetable acids, and a few other neutral salts. The small quantity of earth found in vegetables, is generally, either calcareous, or a mixture of all sorts of earths, and sometimes of the calces of iron and manganese in various proportions, according to the species of vegetables. Thirty three pounds of oak afford only three drachms of ashes.* Sage says, vegetables are composed of an igneous acid, oil, water, an absorbent earth, iron, and a small proportion of gold.

Homogeneity is not to be found, by any known investigation, in any kind of body whatever; the nicest operations can never produce an

* Kirwan.

an ultimate simple body. Those which have been reckoned such, are yet divisible into others, which are themselves compounded, and so on beyond the possibility of human conception. After every part of a plant has attracted its own kindred particles out of the water, even the sweet flower itself, or the expressed juice of the grape, each will be found compounded of very different particles; and so will the most simple fluids in animal bodies. Even our own weak inquiries can shew us thus much, by analyzing milk, chyle, or any other secreted juice from the general mass: and who can say, the most refined essential oil, or spirit, is not yet compounded of other parts? The grosser operations of nature, only, come within the sphere of our limited understandings; but all that regards extreme minuteness, in every respect is utterly beyond that sphere. In short, we must at last own, that the different particles that go to constitute the most simple bodies we are acquainted with, are innumerable, and never to be comprehended by any human power; whence one would be easily influenced to conclude, that every sensible part of the creation is composed of particles of a surprizing variety of qualities, which, according to the different proportions of their quantities in the composition

tion of each body, cause the apparent difference to be every day found amongst them. And in order to conceive this the better, we need only to cast our eyes on the surprizing variety of different colours that are to be composed out of four or five only, by altering their proportions in mixing them; just so it is with regard to tastes, smells, and every other quality whatsoever in bodies.*

How various are the juices of the same tree or plant! Why are the bark, leaves, and woody parts bitter, sour, insipid, restringent, whilst the fruit is sweet, grateful and refreshing? Why are the leaves of trees fœtid, or void of any smell, whilst the flowers yield the most agreeable and pleasing odours? And in a word, why do the several fruits and flowers of the earth differ from each other in taste, smell, virtues and appearance? This we cannot explain any more than we can that bounty of providence, which renders so many trees, shrubs, and plants fruitful, not only for man, but for every other animated being; and which places those of a soft texture, and which would be crushed by a fall, such as the mulberry, fig, plumb, peach, apricot, nectarine, &c. near to the surface of the

* Parsons.

earth; while on the contrary, it places those of hard shells, which do not readily break, such as the cocoa-nut, the chesnut, the walnut, &c. at a considerable height.

The motion of the sap in plants, is a fact which none of the writers on vegetable statics have doubted. They have not, however, been uniform, or even consistent among themselves, in explaining it. The bleeding sap begins to flow at the root, ascends slowly, and as it ascends, the tree bleeds successively to the utmost extremities. One year on experiment, the sap required 43 days to ascend twenty feet in the trunk of a birch, that is, on an average, nearly six inches each day; another year, in the same tree, the sap ascended to the same height in 33 days, or about nine inches, each day. In neither of these experiments, could the sap be perceived to arise either by the pith or the bark; the whole was conveyed by the wood, and between the wood and the bark. It appeared also, that the sap moved both in the substance of the lignean circles, and in the veins by which they are separated, and in both, that it was in an *ascending* state. With a few exceptions, the ascent of the sap is constantly promoted by heat, and retarded and even stopped

ped by cold. The sap, before the leaves of the trees appear, continually rises; what course it takes after that period, is not so certain.* But what is the vegetable earth that we have spoken of, whence this sap is deduced? Vegetable earth, is a compound of clay, of quartz, of an absorbent earth, of a volatile alkali, and of iron, to which it owes its brownish colour. This earth is produced by the spontaneous decomposition of animals and vegetables. All earths, indeed, do not contain specifically the same constituent parts; and hence, some are more, and others less proper for vegetation. This earth likewise exhausts itself, unless renovated by manure.† Thus, as vegetables derive more substance for their support from air and water than from the earth, so when they decay, they restore more to the earth than they received from it. But animals restoring less to the earth than they derived from it, and men, in particular, consuming vast quantities in fuel and other purposes, it would seem to follow, that in populous countries, the stratum of vegetable earth must be constantly on the decline, and must at length become like the surface of Arabia Petrea, and many other of the *first inhabited* parts of the earth, where

* Dr. Walker. † Sage.

nothing at present is to be found but salt and sand, the fixed salt of vegetables and animals always staying behind, while all the other parts of bodies become volatile, and fly off. *

This, however, is to be considered in a more familiar point of view. The soil, once proper for the production of some sort of vegetable, does not always continue to be so, but in process of time, loses its property; and this sooner in some lands than in others. If wheat, for example, be sown upon land proper for that grain, the first crop will succeed well, and perhaps the second and third, as long as the ground is in heart, as the farmers call it; but in a few years it will produce no more, if sown with that corn; some other grain it may, as barley; and after this has been sown so often that the land can bring forth no more of it, it may afterwards yield some good oats, and after them, perhaps pease. At length it becomes barren; the vegetative matter, with which it at first abounded, being reduced by the successive crops, and most of it borne off. Each sort of grain imbibes that peculiar matter which is proper for its own nourishment. It may be brought to bear another series of the same vegetables;

* Buffon.

getables; but not until it be supplied with a new fund of matter, of the like sort with what it first contained, either by leaving the ground fallow for some time, till the atmosphere in air and rain has poured a fresh stock upon it, or by manuring it. That this supply is of the like sort, is evident from the several manures found best for vegetation; which are chiefly, either parts of vegetables, or of animals. These, when refunded to the earth, serve for the formation of other like bodies. The same is observable in gardens, where the trees, shrubs and herbs, after continuing in one station till they have exhausted the greatest part of the matter fit for their increase, will decay and degenerate, unless fresh earth, or some fit manure be applied to them. It is true, they may maintain themselves there for some time, by sending forth roots further and further to an extent around, to fetch in more provision; but at last they must have a fresh supply, or they themselves must be transplanted to some place better furnished with matter for their subsistence.

The upper stratum of this globe is mostly composed of vegetable and animal matter, and is in perpetual fluctuation. All the animals and vegetables, which have existed since the

creation, have successfully extracted from this stratum the materials from which their bodies have been nourished and preserved; these they have again restored at their dissolution, and have in consequence served for new bodies of the same species. Yet, though the vegetative principle may be locally exhausted, it yet does not follow, that soil likewise becomes exhausted. On the contrary, the soil of plains, from the various substances washed down from high lands, becomes considerably augmented: coins have been dug up from eighteen feet below the surface, which had not an existence of above two centuries. Medals have been found of Julius Cæsar under trees seventeen feet below the surface. Trees have been found even at the depth of fifty feet. Earthquakes, and the filtration of water, by loosening the consistency, have likewise made secondary mountains incline and tumble down.*

The physiology of vegetables may be briefly imagined thus. All the organs of vegetables are destined to the execution of different functions. 1. A kind of circulation. 2. An alteration of the fluids, or a secretion. 3. A growing and unfolding performed by nutrition. 4. An

* Buffon.

4. An exhalation of different fluids, elaborated in the organs; and the inhalation by the same organs, of certain properties contained in the atmosphere. 5. An internal action of air, and its operation in the vessels. 6. A motive principle in some of their parts. 7. A kind of sensibility, which makes them search the contact of such bodies as are useful to them, as the light, &c. And 8. a generative principle, or a power of propagating their species. The sap of a vegetable, as I have already said, is destined to the same purposes as the blood of an animal. It abounds in the spring season, as is manifested by the developement of the leaves and the flowers. It mounts from the root to the trunk and branches; but as above noticed, it is not perfectly understood, whether it descends again. It is elaborated into saccharine, mucilaginous, oily fluids, which come from the vegetable in organic excretions, and from which evacuations it apparently derives advantage. The odour of vegetables is looked upon as an inflammable gaz of a peculiar nature. Many exhale vapours, which are mortal to the animals exposed to them. The leaves of all, exposed to the light and to the sun, scatter in the atmosphere an invaluable fluid, a dephlogisticated air. The shade deprives them of that

property. Vegetables purify the air more than they injure it. The lower surface of leaves absorbs the humidity occasioned by dew, as proved by Bonnet. The whole of them absorb the gaz left by fires and respiration, according to Priestley.*

The absorbed gaz is carried through all the organs by vessels, similar in structure and usage to those of insects and worms. They appear to answer the same purposes as the lungs in animals. They have, however, been found full of a sappy juice, at the time when the sap abounds, which puts them at a considerable distance from the organs of respiration, so essential and so uniform in animals. It cannot be doubted, but that there are some parts of vegetables, which have motion. Some have it so strongly as to be discernible by the naked eye; such as the sensitive plant, &c. This, however, as it is said to be occasioned by the action of a stimulus, belongs to what is called irritability in animals. But those who *turn* their faces to the sun, or light, so as to twist themselves quite round, as the *hedysarum movens*; or who ensnare insects in their leaves, and then closing, crush them to death, as the

dionæa

* Fourcroy.

dionæa muscipula, or Venus's fly-trap; or who, as the mallow, present their leaves in the morning to the east, at noon to the south, and at the declension of the sun to the west, prove something more than irritability. Thales conceived water to be the first principle of all natural bodies; first, because natural seed, the principle of all living creatures, is humid; the consequent probability being, that humidity is also the principle of all things: secondly, because all kinds of plants are nourished by moisture, wanting which, they wither and decay: thirdly, because fire, even the sun itself and the stars, are nourished and maintained by vapours proceeding from water, and consequently the whole world must consist of the same.* This he borrowed from the Phœnicians. The chaos from which all things were made, according to Hesiod, was water.

The sexual distinction of plants, which I have already mentioned, is only an ancient idea modernly revived. Empedocles agitated the question, whether the male in plants was found separate from the female, or whether they were joined in certain vegetables. He himself concluded them to be hermaphrodites. *Empedocles vero*

* Plutarch. Stobæus.

vero sexum his admistum esse putavit. "Natura-"lits," says Pliny, "not only admit the dif-"ference of sexes in trees, but also in herbs and "every species of plant. But the instance the "most remarkable is the palm, the female of "which never produces, unless she is fecundated "by the dust of the male."* It does not, however, appear from any of the writings of the ancients, that their researches into the process of nature, in the propagation of the various species of vegetables, went farther than their observations on this very palm tree, and some similar observations on the fig tree. They had, indeed, from what they saw in these plants, formed a notion, that all others were male and female.† But here, as we have above seen, they erred, for the greater part have hermaphrodite flowers. In this dark state, the doctrine of the sexes of vegetables remained, not only through long ages of antiquity, but almost to the end of the last century. The honor of having first suggested the true sexual distinction of plants, appears to be due to our own countryman, *Sir Thomas Millington.* After him came various others. Linnæus at length founded his System of Botany; engrafting his own observations on their enquiries and experiments. And

* Duten. † Theophrastus.

And from all, it has generally been concluded that the birth of animals is not more evidently the consequence of an intercourse of sexes, than that of vegetables.* One remarkable experiment, on the *palma major foliis flabelliformibus*, will confirm it. A tree of this kind, in the garden of the Royal Academy of Berlin, had flowered and borne fruit for thirty years, but the fruit never ripened; and when planted, did not vegetate. The palm, as you know, is a *planta dioecia*, or one in which the male and female parts of generation are upon different plants; and which is in contradistinction to *monoecia*, or one habitation, where the male and female flowers are both found on the same plant: and to *trioecia*, where they are found on three different plants. Having no male plants, the flowers of this female were never impregnated by the farina of the male. At length, a branch of male flowers was procured from a male plant in the garden of Leipsic, twenty German miles distant from Berlin. These flowers were suspended over the female. The consequence was, the palm tree produced an hundred perfectly *ripe fruit*, from which sprang up vigorous young trees; and on the experiment being repeated, upwards of two thousand.† The three prin-

* Philosophia Botanica. † Philos. Transact.

principal systems, however, respecting the generation of animals, have been transferred with the necessary modifications to plants. Some think the embryos *pre-exist* in the ovarium; others, that they are *transported* thither in the impregnating farina; and others, that they are generated in the ovarium by the *combination* of two fecundating principles, the one furnished by the pistil, and the other by the stamina. Should we be content with first appearances, we might perhaps think that system preferable, according to which, the embryos of plants are conveyed, at the time of fecundation, by the powder of the *antheræ* into the ovarium; for the embryos have never been found in this organ before the aspersion of the powder. They always make their appearance after the pollen has been observed upon the antheræ. Hence it has been inferred, that the embryos pre-exist in the pollen. But it is magical, to contend that the embryo does not exist in the ovarium before fecundation, because it is not visible before that time: we are not to argue from invisibility, non-existence. In the *impregnated egg*, the best microscope will not bring the chicken into view, although we are sure it is there.*

Bonnet,

* Spallanzani.

Bonnet, in treating of the sexual system, which he had warmly espoused, says in an Address to Spallanzani, "I am at length entirely "convinced by your experiments, that all the "great naturalists whom I have looked up to, "as well as myself, have been deceived. We "had all formed a hasty decision, and drawn a "general conclusion from particular premises. "We had deduced the necessity of the pollen, "in fecundation, from experiments made on "different species of plants; whereas we ought "only to have said, it seems to follow, that in "such species, the influence of the pollen "appears to be necessary to fecundation." Spallanzani, indeed, to ascertain this point, had made a variety of experiments on the *gourd*, all of which proved, that it propagated without being impregnated by the pollen. It is impossible, says he, to suspect, that the powder of the male flowers, growing upon the same plant with the female flowers, had any share in producing this effect, because I destroyed them long before it was ripe. Nor can it reasonably be presumed, that any pollen was carried by the air to the spot, from places at a distance. There was not a gourd of the species in the neighbourhood. We must, therefore, of necessity conclude, that neither the embryos of this plant,

plant, nor its fructification, depended upon the powder of the stamina.

Spallanzani again endeavoured to prevent the access of the impregnating dust into the ovaria of three descriptions of plants: the hermaphrodite; those which bear separately male and female flowers; and lastly, those which produce both male and female together. The antheræ of the first were cut away before the ripening of the pollen; in the second, the male flowers were extirpated, and the female of the third were insulated. In the hermaphrodite plants, it appeared that the privation of the pollen did not prevent the appearance of the embryo in the seed, though the seeds were incapable of germinating: in some plants, the absence of the pollen neither hindered the embryos from appearing, nor the seeds from being productive. The same observation was to be applied to several plants with female individuals; but, in other plants of the same class, the want of pollen rendered the seed sterile, though the embryo appeared in them. The direct and immediate consequence of these results is, says Spallanzani, is obvious: for if the embryo appears without the co-operation of the pollen, and if beside, in many cases, the seeds grow, it is clear their existence can have no dependence on the pollen;

and

and upon those occasions, on which the seeds do not grow for want of it, we can only say, they stand in need of the condition necessary for their future evolution, as the fœtuses of animals do not thrive for want of seed, although they exist in the ovarium of the female. Another consequence is, that as the embryos do not belong to the pollen, they must necessarily appertain to the ovarium. The seeds pre-exist, and the embryos in them, long before the opening of the flowers.*

Haller was the first philosopher who shewed that in birds, the fœtus exists before fecundation. Spallanzani extended this discovery to different species of amphibious animals; and these facts led him to believe it probable, that the same pre-existence took place in all animals. What had been discovered in various individuals of the animal kingdom, had been also observed in several sorts of plants. But he did not venture to affirm, that the embryo in all cases, existed before the opening of the blossom. He only observed, that till the contrary should be proved, there was just reason to continue in the belief, that pre-existence was universal. If we inspect the ovaria before fecundation, we shall find the seeds externally solid: they continue in

* Spallanzani.

in this state for some time after fecundation. They afterwards become hollow within; in the cavity appears a small body, not distinguishable indeed at first, but afterwards known to be the embryo, or the plantule with the lobes. The embryo sometimes seems detached from the seeds, and floating in a liquid; and sometimes attached by one or more connecting threads. Is not this very analogous to the animal ovum before and after impregnation? The shell of the egg and the case of the seed, appear evidently for the same purpose. The germ in each becomes visible only after impregnation.

That nature should require the influence of pollen in order to multiply one species, while it is not necessary to others, is perfectly conformable to what we every day observe in animals. Numberless animals are incapable of multiplying without the concurrence of both sexes, or at least without the intervention of that fluid upon which the species depends. But a vast number, on the contrary, propagate without such means; for instance, the polypi, which we have fully considered already, and the animalculæ of infusions. Some also are internally, and some externally fecundated. But the plant *Mercury*, puts the necessity of pollen in some instances, in so clear a point of view,

view, that no other in reality, is necessary to be adduced. The female of this plant, when it is placed at even no very great distance from the male, still remains barren, because the fecundating atmosphere of the latter is not far enough disseminated, from the small quantity of pollen with which it naturally is furnished. If the male be brought near the female, she will bear some productive seed; but, if the male be placed almost in contact with the female, the greatest part of the seed will adhere, ripen and germinate. Should the male be again removed, the female returns to her former sterility. The turpentine tree also seems to be affected in a similar manner.

Moreover, as there is a great diversity, but a regular succession in the times in which animals of different species are stimulated to the propagation of their respective kinds, an order equally determined is observable in the times of accomplishing the *sponsalia* of plants. The periods of incubation in oviparous, and of gestation in viviparous animals, are not more various in different species, nor probably more definite in the same, than the periods requisite for the germination and maturation of different seeds. By the influence of heat and cold,

abundance and scarcity of nourishment, the seasons of propagating may be somewhat accelerated, or retarded, in animals as well as in vegetables. The effects of a cold ungenial spring are as remarkable in the retardation of the procreative intercourse of birds and beasts, as in the stoppage of the leafing of trees, or the flowering of shrubs. In a word, there are so many circumstances in which the anatomy and physiology of some plants agree with those of some animals, that few I believe, can be mentioned in which they disagree.* And here, indeed, we should particularly remark the striking difference, which has in this instance been established, between the vegetable and the mineral kingdom. This last, we can consider in no other light than as a mass deprived of organization, and almost in an elementary state; receiving no modifications or changes but by the impression of external objects; capable of entering into combinations, of changing its nature, and of reappearing, or being reproduced with its original properties, at the pleasure of the animal man. The other kingdom, on the contrary, being endued with a particular life, which incessantly modifies the impression of external objects, decomposing them and chang-

ing

* Bishop Watson.

ing their nature, exhibits to us a series of functions regular throughout, and almost all of them inexplicable: and when man has succeeded in depriving these bodies of their organization, and separating their principles, he finds it beyond his power to reproduce them by any reunion of the same principles.

From this mysterious principle of propagation, what variously scattered families of the vegetable world are kept in existence! To number them would be impracticable. Many thousands are already known; and yet very considerable portions of the earth are yet unexplored. From these, in the progress of time, what botanic riches may not be expected! Millions probably will not bound the catalogue. Every corner hath a plant peculiar to itself, at least a plant, which in its immediate fostering bosom, will arrive at its greatest perfection. There are islands in the South Seas, which have a vegetation peculiar to themselves; and which has nothing in common, either with the other islands, or with places in Africa and America situated in the same meridian of latitude; a sort of *antediluvian* generation.

The earth thus alone, is above all the elements, every where found the benefactor of man. The body of waters deluge him with rain, oppress him with hail and with snow, and drown him with inundations. The air rushes in storms, prepares the tempest, or lights up the fire of the volcano. But the earth, gentle and indulgent, and ever subservient to his wants, spreads his walks with flowers, and his table with plenty, and returns with interest, every good committed to her care. Though she produces the poison, she still supplies the cure; though constantly teized more for the luxuries than for the necessaries of man, she still continues her kind indulgence; and when life is over, she piously covers his remains in her bosom.*

Man, in order to live with pleasure and contentment, feels the occasional want of a vast variety of accommodation. The Almighty, it is true, might have placed all his necessary demands on the surface of the earth, to be ready at his hand upon all occasions; but then the multiplicity of them would have covered the whole earth: whereas, in their present situation, they are no incumbrance. Metals, fossils, and an infinite variety of other materials, which are not

* Goldsmith.

not only of daily service to ourselves, but were intended by providence as a treasure, never to be exhausted, are carefully lodged under our feet, where we may infallibly find them upon emergencies. They do not lie buried at the centre of the earth, nor so deep in its entrails as to be inaccessible; yet they are planted at a convenient distance from its surface, that the soil may produce its proper fruits in their due season, without interruption. And thus the same spot of ground produces for our service, a double kind of harvest.*

The nutritive juices produced by the mutual concurrence of the air, water, and the earth, the natural matrix of the vegetable kingdom, are clearly ascertained to be an heterogeneous fluid, composed of all the species of juices which are found in every part of every tree and plant indiscriminately; and this must be looked upon as the general repository of provision, for all those vegetables which are nourished by them, in whatsoever climate they grow. Further, we must look upon the seed or ovum, to have treasured up in it, originally, a sufficient quantity of every one of the particular juices of its parent, each in its own peculiar

* Spectacle de la Nature.

liar vessel, proportioned to the capacity of its receptacle, whether it be a primary or a secondary organization of tree or plant; or in other words, whether it be the seed or bud. Hence the ease with which the pine apple now is propagated. The particular juices of this fruit are in the soil which is made for it, and in the heat which is produced. All other exotics might in the same manner be cultivated, if the due degree of heat necessary for them could be continually ascertained, which from our situation and distance from the sun, is naturally impossible. The saccharine, spicy, and all other juices, are in the general repository of every soil whatever; and if they are not in such masses and quantities in some, as in their peculiar native plants, yet they every where abound in others, as component parts of their juices. What but saccharine juices, gives the mellow sweetness to the ripe apple, the cherry, the pear, the plumb, &c. although varied in taste, by the different admixture of other peculiar component juices of these several fruits? What but the spicy juices, gives the warm pungency to our different aromatic and cephalic plants? The capsicum thrives here, and produces very large pods; and so do variety of other plants, which are native of other climates.*

The

* Parsons.

The saccharine principle, or sugar, resides in almost all bodies we are acquainted with. It is a substance *sui generis* in appearance; but in a chymical resolution, is found complex, and mixed with a variety of matter. It partakes of the nature of saline bodies, as is evident from its crystalizations. This salt is most probably an acid, and that which gives it its activity. An oily substance likewise enters into its composition, which gives it its unctuous and saponaceous quality. Thus an acid, an inactive earth, and an oil, constitute the basis of sugar. The juices of almost all plants, that contribute to their nourishment, are of this nature. It is even one of the principal qualities that enters into our own food. It is a grand promoter of fermentation.* Sugar, says Bergman, being justly considered as an essential salt, it will readily be granted that it contains an acid; this acid may be separated and exhibited in a chrystaline form. The acid of sugar, also, occurs in the animal kingdom, for together with a gluten, it constitutes the urinary calculi. The saccharine acid attracts lime with such force, that it separates it from every thing else, and can only be decomposed by fire. Hence lime is used in the refining of sugar. Nothing attracts the super-

* Farr.

abundant acid of the juice of the cane, so powerfully; and when united with it, it is insoluble, and either falls to the bottom, or floats in scum. The *Abbé Fontana* obtained an acid perfectly like that of sugar, and saccharine substances, from all gums and resins. Few vegetables, indeed, but exhibit some acid more or less developed. We see, for example, all fruits, insipid at first, become insensibly acid; and finish by losing that taste, and becoming saccharine. Physicians, it is true, have asserted that the use of sugar was hurtful, on account of the lime used in refining it. But this is erroneous. Not a particle of lime remains in the sugar. Sir John Pringle, on the contrary, supposed, and with great probability, that the frequent use of sugar, and fresh vegetables, abounding as they do with fixed air, which at this time make up a considerable part of the diet of European nations, prevents those putrid diseases and plagues which were formerly so frequent. Sugar in fact, says an able physician, is an excellent food; and it is merely an old prejudice to suppose it produces worms in the bowels of children.*

Most vegetables which contain sugar, go through *three* fermentations. First, they give a wine.

* Chaptal.

a wine; secondly, a vinegar; thirdly, losing their acidity, they change, rot, part with their volatile properties, and finish, by being nothing but a dry, insipid, earthy substance. There are some, indeed, which only go through the two last. After a knowledge of vegetables, therefore, it is of consequence to be acquainted with the alteration they go through from this process of fermentation. Fermentation is a spontaneous movement, which totally changes the properties of an animal or a vegetable. Some circumstances are essential to all fermentation. A certain degree of fluidity; for dry substances undergo no fermentation: a heat, more or less strong; for cold stops fermentation entirely: the contact of air; for in a vacuum, bodies remain in preservation. The natural juices of vegetables that have never been inspissated, as that of grapes, and other fruits, when fully ripened, usually ferment as soon as they are expressed, without any external assistance. But as a certain degree of inspissation prevents all tendency to fermentation in vegetable juices, otherwise strongly disposed to ferment; so long a continuance or increase of the inspissating heat, especially if it acts immediately through a metalline or solid body, upon the juice, will destroy its fermenting property; and this the more

more effectually, as the heat employed approaches to that of scorching, or the degree capable of giving an empyreuma. There is one certain degree of heat, the least increase of which proves detrimental or destructive to fermentation; as there is another, which wonderfully encourages and promotes it. A fervid heat is the bane of all vinous fermentation; as a tepid one, or rather an imperceptible warmth, is its best promoter.

Beside the essential salts, such as sugar, &c. which are extracted from vegetables, there are various other juices. They abound with all sorts of gums and mucilages. Not to say any thing of the metals, gold, iron, and manganese; although you would not be displeased to see iron extracted from an oak, or gold from a vine. Oils also are universal. These oils are the fat, unctuous juices, either fluid or solid; indissoluble in water; combustible, and volatile in different degrees. They are never formed but by *organic bodies*; and therefore, all the substances, which present an oleagenous principle in the mineral kingdom, owe their origin to animal or vegetable beings. Plants which have no odour, never afford an atom of oil. Oils are supposed by Boerhaave and Macquer,

to

to be in general composed of an inflammable substance, and a saline substance. Resins and balms, are concreted oils; such as common resin, benjamin, assa-fœtida, myrrh, &c.* In regard to amber, the doubts which had arisen about it, seem now to have vanished. It is nothing more than the juice of a tree, inspissated by evaporation into a concrete form. This tree, at this day grows in *Guyana*, and is called *cuma*. M. Aublet, who wrote the History of Guyana, distributed some specimens of this gum resin, which he had collected on the spot from the cuma tree. Beside this authority, *Rumphius*, quoted by Bergman, long since mentioned a tree, called *nanarium*, whose inspissated juice resembled amber.† And even to go beyond him, *Cassiodorius*, in treating of the Baltic, describes the amber for which those shores had long been famous, and calls it the gum of a tree, hardened by the sun, and purified and wafted by the waters.‡ The point is clear, therefore, at present, that the origin of this phlogistic substance is in the vegetable kingdom, although it may be often found, and reputed, as a product of the fossil kind. Beside these, there is the *fecula* of vegetables, which appears only to be a slight alteration of mucilage.

For

* Fourcroy. † Magellan. ‡ Gibbon.

For instance, a fecula, which is appropriated by us to domestic uses, is extracted from the pith of several farinaceous palms, and is known by the name of sago. M. Parmentier has proposed to make sago out of potatoes; in consequence of his idea, that all fecula are absolutely identical, and that this principle is one and the same in nature. The fecula of saloop, pulverized, and combined with water, forms a very nourishing jelly. In short, M. Parmentier is decisively of opinion, that fecula is truly the most suitable nourishment for man: but whether this be the case or not, Lord Dundonald has incontestably made a bread from the potatoe, which he represents as extremely nutritive, cheap, and agreeable to the palate; and so far at least, strongly corroborates some part of the benevolent, though perhaps enthusiastic reasoning of M. Parmentier.

We have already examined with attention, the nature of coal and of bitumens, and we have ascribed to them the like organic origin. But, there is a substance, which we have daily in familiar use, which is still more singular in its nature, *Vegetable charcoal.* All vegetables afford charcoal; wood more than herbs; gums more than resins; and resins more than fluid oils.

oils. There are, however, considerable differences in the coals of different vegetables, in regard to their habitude to fire: the very light coals of linen, cotton, some fungi, &c. readily catch fire from a spark, and soon burn out; the more dense ones of woods and roots, are set on fire with more difficulty, and burn more slowly: the coals of the blackberry bearing alder, of the hazel, the willow, and the lime tree, are said to answer best for the making of gun-powder: for the reduction of metallic calces, those of the heavier woods, as the oak, and the beech, are preferable, these seeming to contain a larger proportion of the inflammable principle, and perhaps in a more fixed state. Considered as common fuel, those of the heavy woods give the greatest heat, and require the most plentiful supply of air to keep them burning. Charcoal, after its transmutation by the fire and air, bears, indeed, the form of its vegetable state, but is no longer possessed of its vegetable properties; it is found to be composed of a combustible matter, a saline substance, an earth and a little water: ninety nine parts in the hundred are inflammable.* When it is burnt, there remains a grey, white, or blackish matter, according to the nature of the

* Bergman.

the charcoal, which is a compound of earthy and saline substances, sometimes mixed with iron. The saline substance, extracted thus from charcoal, is called fixed salt, as the pot-ash, *kali*, or the ashes of which glass is made.*

Charcoal, in reality, seems to be an indestructable substance, except it be burnt in the open air, or its phlogiston be made to pass into other substances ready to receive it. Neither acids, alkalis, air, water, or any other menstrua, have any power upon it. But the air which it emits is more destructive; and this perhaps, not only from its being inhaled, but from its being absorbed by the pores of the system. Some parts of the substance of air, says Boyle, do not only affect human bodies, or at least many individuals among them, as they are taken in by respiration, but as they outwardly touch the skin; and the skin being full of pores, those corpuscles that get in at them, may have their operation, even upon the most inward parts of the body. There has been a very extraordinary circumstance, however, lately discovered in regard to this inflammable air. Though long known to be improper for sustaining the life of animals, it yet was not known to

* Fourcroy.

to have the property of destroying and dissolving the animal texture. M. Charles, having put frogs into a flagon filled with inflammable air, they died in a very short time, and about three weeks after, he found them reduced to a reddish grey fluid: their cartilaginous parts were all destroyed likewise; for their bones were all separated from each other. Sage repeated this experiment on a single frog. It swelled and died, and a bloody liquor issued from it, whose quantity augmented every day. Charles observed that frogs put into a flagon filled with nitrous air, mephitic air, and dephlogisticated air, died in them, but nevertheless preserved their form, and were not reduced to a fluid.* May not this dissolution of organized bodies, by the operation of inflammable air, lead observers to discover the occasion and principle of these diseases, which are incident to the inhabitants of marshy countries in warm climates? And may it not lead them to discountenance that pernicious custom, so universal in some parts abroad, particularly in Italy, of both men, women, and children, constantly warming themselves, and inhaling the mortal air of charcoal, from their brasiers? Nothing is more

* Mem: de l'Acad. Royale des Sciences, 1784.

more common in those countries than apoplexy: whence originates such fatality?

It is a vulgar error to believe, that any kind of fire is beneficial, or can possibly purify air, by destroying the noxious particles mixed with it. Fires are indeed of use, because they promote the circulation of the air, and dry the dampness of rooms and furniture; so that it is not the infected air that is purified, but, it is new, fresh, and wholesome air, that by the action of the fire, has taken the place of the infected air; which infected air, being rarefied by the heat, has left the room. Fire and combustion, so far from purifying, actually contaminate a prodigious quantity of air. A constant ventilation is the only way of purifying an apartment; for *cæteris paribus*, the air of a place is more or less pure, according as it is more or less ventilated. I have already noticed to you, how air is vitiated; how putrescent vegetables, as well as putrescent animals, injure it. Fresh meat, even without the least sign of putridity, phlogisticates common air considerably, and in a short time. Fresh paint, made of white lead and oil, is highly offensive and hurtful; but nothing is so deleterious as charcoal.

It

It is said of the human species, that many of the discharges, especially from the surface of the body, and from the lungs, are even in the most healthy persons, in a state not very remote from putrefaction; but, in persons labouring under disease, they are of a still more noxious nature. Hence persons in health, are often injured by sleeping in the same beds with invalids; and hence it is peculiarly necessary to have the apartments of the sick well aired and ventilated; and their apparel, especially their linen, frequently changed. If this, then, be pernicious, what must be the poisonous, inseparable companion charcoal? And here let me beg of you to bear in memory, what I lately had occasion to mention to you, that strong as the prejudices against fossil coal fires may be upon the continent, they yet are less hurtful than even the fumes are, which arise from burning wood. Charcoal, indeed, is deadly poisonous; but, fires being necessary, good coal, on trial and experiment, is found to give less tainted effluvia, and to be more innoxious than common wood.* But, to return to our subject. Vegetables are divided into seven families, or tribes. 1. *Fungi*, mushrooms. 2. *Algæ*, flags; whose root, leaf, and stem, are all

* Falconer.

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one. 3. *Musci*, mosses; whose antheræ have no filaments, and are placed at a distance from the female flower, and whose seeds want their proper tunic, cotyledon, or placenta. 4. *Filices*, ferns; whose fructification is on the back of the leaves. 5. *Gramina*, grasses; as also the various sorts of corn, that have simple leaves, a jointed stem, a glumose calyx, and a single seed. 6. *Palmæ*, palms; which have simple stems that are frondose at the summit, or a species of trunk, composed of a branch and a leaf blended together. 7. Plants, which include all that do not enter into any of the other divisions; and these are herbaceous, when they die down to the root every year, for in the perennial kinds, the buds are all produced on the root below the surface of the ground. Shrubs, when their stems come up without buds. Trees, when their stems come up with buds.*

Vegetation seems to be one of the first, and immediate properties of nature; though vegetation itself is evidently referable to a higher design. Upon this account, few parts of the surface of the earth are vacant and unemployed. Plants are as various as the soil, the air, and the situation of the different places in which they grow.

* Philosophia Botanica.

grow. Obeying and accomplishing one great benevolent design, they are all either pleasing, or useful, or both. Some contribute to the ornament of the earth; some afford food and medicine to the inhabitants; and others supply pastures to the animals destined for their use. There is hardly a plant, that, though rejected as food by some animals, is not ardently desired by others. The horse yields the common water hemlock to the goat; and the cow, the long-leafed water hemlock to the sheep. The goat, again, leaves the aconite, or bane berries to the horse, &c. Plants, which afford proper nourishment to some animals, are by others avoided, because they would not only be hurtful, but even poisonous. Hence, no plant is absolutely deleterious to animal life. Poison is only a relative term. The euphorbia, or spurge, so noxious to man, is greedily devoured by some of the insect tribes.† Even the pollen is given over to us, with very little alteration in the form of wax. The nectar of flowers itself, the honey, is contained chiefly in the base of the pistil, or female organ. It undergoes no alteration in the body of the bee, since we can form honey by concentrating the nectar: it, however, always retains the odour, and not unfre-

* Smellie.

quently the noxious qualities of the plant which affords it. It fairly may be considered as the vehicle and recipient of the fecundating dust, which facilitates the bursting of the globules, and serves to the germination of the individual. It exudes from all the female parts, but particularly from the ovaria, and is the humour afforded to receive the fecundating powder. Pores may even be observed in hyacinths, through which it flows.†

† Chaptal.

LET-

LETTER LX.

SO various, and so unbounded are the phænomena with which nature teems, and in such mysterious manner does she present her products to us, that the wise man, at every step he advances, still becomes more diffident of general assertions, and more cautious in assenting to what may, or may not possibly be true. Contemplate even the most common operations of the animal and the vegetable world. Are they not all amazing? Is there any thing but daily experience and constant observation, which can enable us without astonishment and wonder, to see an animal bring forth another of the same kind, and a tree to blossom, shove out its leaves, and ultimately bear fruit? In our preceding enquiries, we have occasionally been induced to consider the accession of bulk to bodies in general. But vegetables were not then under our investigation. It was long imagined, that all the great operations in nature

are to be reduced to two principles, those of crystallization, and organization; but, that often they are so concealed as to be invisible. Hence crystallized substances have been often mistaken for organized ones, and *vice versa*. They differ, however, essentially in their growth and origin. Organized beings spring from a germ, in which all the parts are concentrated, and they grow by general expansion; whereas, crystallized substances increase by the successive apposition of certain molecules of a determined figure, which unite in one common mass. Thus crystallized bodies do not grow, properly speaking, though their substance is augmented; they are not pre-formed, but, are formed daily. *

A vegetable is possessed of solidity and extension, those general standards, by which matter is distinguished from spirit. It acknowledges gravity and attraction, as do material bodies. But it, at the same time, possesses many properties, and is to be distinguished by many affections, of which matter never can, nor ever has been observed in the least degree to partake. It is therefore a distinct being, and is so distinct by possessing life. Matter may be moved,

* Adams.

moved, but, if you remove a plant, and insulate it, you destroy its existence. It is stationary. Perception is not distinguishable in this tribe of beings; yet, it is difficult to deny it them. They are raised from seed; nourished and protected during their existence; they then fade and die away. Perception may be necessary, though not consciousness. But, perception denied, they cannot be refused the property of irritation, or a capacity of receiving impressions from other parts of matter. The continual absorption of nutritious matter, does not surcharge the vegetable, as infallibly would happen to any material substance, as an absorbent earth, &c. On the contrary, it enlarges and protects it; the parts formerly concealed become progressively developed; and the whole figure undergoes a total transformation. All plants have their peculiar food. A wholesome, and a poisonous vegetable, however, will feed from the exclusively appropriated juices of the same soil.* But, as I have repeatedly said, irritability is the principle which constitutes vegetable life. The celebrated Gmelin shews, that the antheræ are irritable, or, at least, endowed with a property nearly approaching to

* Farr.

the property of animals called irritability. He adduces many instances exceedingly remarkable, and among others, that of the *orchis*, the antheræ of which, recently gathered, and irritated in a warm place, appear to contract, and then to relax, and to undergo a kind of tremulation. *

The ancients, who were not so good naturalists as the moderns, but, who were equally sensible of the incomprehensibility of the works of God, looked upon plants as living bodies. Plato was of the number. A few of the most enlightened of the moderns, have adopted the same opinion; at the head of whom is Spallanzani, who is justly esteemed one of the greatest naturalists of the present age. Those who are of a different opinion say, the difference between vegetables and animals consists in a *system of nerves* which belongs to animals, but not to vegetables. Vegetables, says Sir John Hill, are placed by nature in the middle state, between the mineral and the animal classes; superior to the mineral, in having organized bodies; inferior to the animal, in wanting a nervous system. They are also capable of growth, but, they are below sensation.

Of

* Spallanzani.

Of the essence and properties of life, we are profoundly ignorant. What life really is, seems too subtile for our understandings to conceive, or our senses to discern. All animals are endowed with sensation, or at least with irritability, which last has been considered as a distinguishing character of animal existence. We acknowledge sensation in organized bodies, when we perceive they have organs similar to our own, or when they act, in certain circumstances, in the same manner as we act. If an organized being have eyes, ears, a mouth, we naturally conclude it enjoys the same sensations, as these organs convey to us. If we see another being, whose structure exhibits nothing analogous to our organs of sensation, yet contracting with rapidity when touched, directing its body uniformly to the light, seizing small insects with tentacula, or a kind of arms, and conveying them to an aperture placed at its anterior end, we hesitate not to pronounce it to be animated. Cut off its arms, deprive it of the faculty of contracting and extending its body, the nature of this being will not be changed; but, we shall be unable to determine whether it possesses any portion of life. This is nearly the condition of the small sections of a polypus, before their heads begin to grow. The wheel-

wheel-animal, the eels in blighted wheat, and the snails recorded in the Philosophical Transactions, afford instances of every appearance of sensation, and even of irritability, being suspended, not for months, but, for several years, while yet the life of these animals is not extinguished, for they uniformly revive upon a proper application of heat and of moisture. If, then, we have no other criteria to distinguish life, than motion, sensation, and irritability, the animals just mentioned, continuing in a state for years, which every man would pronounce to be perfectly dead, life may possibly exist in many bodies which are commonly thought to be as inanimate as stones.*

Wherever there is a vascular system, containing a moving nutritive *succus*, there is life; and wherever there is life, there may be, for aught we can prove to the contrary, a more or less acute perception. The same kind of comparative reasoning, that would exclude vegetables from the faculty of perception, might equally exclude from animality, those animals which are provided with the most obtuse senses, when compared with such as are furnished with the most numerous, and most acute. The perception

* Smellie.

tion of man seems to be indefinitely greater, when compared with that of coralines, sea pens, and oysters, than the perception of these, which are allowed to be animals, when compared with the signs of perception manifested by a variety of what are called vegetables. Should I not rather call one of the blooming, gentle, and affectionate daughters of humanity, the sister of the lily of the valley, or of the rose, than of the muscle or of the barnacle? Spunges open and shut their mamillæ; corals, and sea pens, protrude, or draw back their suckers; shell fish open or keep close their shells in search of food, or avoidance of injury; and it is from these muscular motions, we judge the beings to which they belong to have perception, that is, to be animals.

In the vegetable kingdom, the *muscular motion* of many plants may be observed, to be to the full as definite and distinguishable, as those of the class of animals just mentioned. The plants called *heliotropæ*, turn daily round with the sun; by constantly presenting their surfaces to that luminary, they seem as desirous of absorbing a nutriment from its rays, as a bed of oysters does from the water, by opening their shells upon the afflux of the tide. The

flores

flores solares, are as uniform in their opening and shutting, as animals are in their times of feeding and digesting: some, in these motions, do not observe the seasons of the year, but expand and shut up their flowers, at the same hour in all seasons; others, like a variety of insects, which appear or not, according to the heat of the weather or climate, open later in the day, or do not open at all, when they are removed from a southern, to a more northern latitude. Trefoil, wood sorrel, mountain ebony, wild senna, the African marigold, &c. are so regular in folding up their leaves before rainy weather, that they seem to have a kind of instinct or foresight, similar to that of ants.* And what is still more extraordinary, vegetables appear to be a sort of *hygrometers*, for in several there is found a contorsion of the fibres, which answers, in every respect, this purpose. The fibres of the plants, being affected by the quality of the air, the spiral part twists, or untwists, as the weather varies, and thus the degrees of dryness or moisture of the atmosphere are to be observed.† Young trees in a thick forest are found to incline themselves towards that part through which the light penetrates, as plants are

* Bishop Watson. † Lee.

are observed to do in a darkened chamber, towards a stream of light let in through an orifice, and as the ears of corn do towards the south.

The roots of plants are also known to turn away with a kind of abhorrence, from whatever they meet with which is hurtful to them; and to desert their ordinary direction, and to tend with a kind of natural and irresistible impulse towards collections of waters placed within their reach. Many plants experience convulsions of their stamina, upon being slightly touched. Whatever can produce any effect upon an animal organ, as the impact of external bodies, heat and cold, the vapour of burning sulphur, of volatile alkali, want of air, &c. is found to act also upon the plants called sensitive. But, we will not insist upon any further instances of that class. We have already noticed many, which seem far superior in quickness to those of a variety of animals. Now, to refer the muscular motions of shell fish, and zoophytes, to an internal principle of volition; to make these indicative of the perceptivity of the being; and to attribute the more notable ones of vegetables to certain mechanical dilatations and contractions of parts, occasioned by external im-

impulse, is to err against the rule of philosophizing, which assigns the same causes for effects of the same kind. The motions, in both cases, are equally accommodated to the preservation of the being to which they belong; are equally distinct and uniform; and should be equally derived from mechanism, or equally admitted as criteria of perception. The generation, nutrition, organization, life, health, sickness, and death of plants, establish no discriminative characteristic between them and animals. A communication of sexes, in order to produce their like, belongs to certain vegetables, as well as to certain animals. Exspiration and inspiration, a kind of larynx and lungs, perspiration, imbibition, arteries, veins, lacteals, and probably a circulating fluid, appertain to vegetables, as well as to animals. Life belongs alike to both kingdoms, and seems to depend upon the same principle in both. Both are incapable of assimilating to their proper substance, all kinds of food; for fruits are found to taste of the soil, just as the milk, and flesh, and bones, and urine of animals, often give indications of the particular pabulum with which they have been fed. Both die of old age; from excess of hunger or

or thirst; from external injuries; from intemperance of weather; or from poisoned food.*

Vegetables of different natures, require different soils, or rather, appropriate juices, as different animals do different food, for their support and well being. Aquatics pine away in dry grounds; and plants, which love rocks and barren situations, where they imbibe their chief nourishment from the air, become diseased and putrid, in rich lands and swamps. The re-production of the legs of crawfish, lobsters, crabs, of the heads and horns of snails, legs of lizards, when by accident or design they have been deprived of them; and the great difference in the time of the re-production, according to the season of the year in which the limb is lost, are wonders in the animal kingdom, but, are wholly analogous to the repullulation of trees after lopping. All plants, as we have already observed, excepting those of the monoecia, and dioecia, are hermaphrodites. Shell fish, and other animals, who are not able to move far in search of mates, are hermaphrodites also. From the conjunction of animals of different species are produced *hybrides*, which in many

* Bishop Watson.

many cases cannot propagate. The same happens among plants: an hybridous species may be generated, the seeds of which are barren and effete. Trees shed their leaves; birds their feathers; and hirsute animals, their hair. Few animals can exist without a reciprocal succession of sleep and vigilance. Several vegetables manifest the same want. The periods of incubation in oviparous, and of gestation in viviparous animals, are not more various in different species, nor probably more definite in the same, than the periods requisite for the germination and maturation of different seeds.*

Thus we find a marvellous agreement between the anatomy and physiology of plants, and those of animals. Nay, it is said, that few circumstances can be mentioned, in which they disagree. Thus, in another instance, in the propagation of their species, from the seeds of a single elm tree, 100,000 young elms may be raised from the produce of one year. A single female bee will produce 40, or 50,000. The fecundity of the cod is enormous. But, in both the animal and vegetable kingdoms, the smallest, and apparently most contemptible species are the most prolific. From all this, ex-

* Bishop Watson.

exclaims an eloquent naturalist, a vegetable may be looked upon as a sleeping animal, as in general every organized body, deprived of sense and motion. Our own being, indeed, commences with sleep: the fætus sleeps perpetually; and the infant consumes most of its time in that state. Sleep is the original condition of animated beings, and the very foundation of life itself. *

Again let us remark, how gradually plants, like animals, pass from an embryo, and infant state, to that of puberty. At this period of their existence, they have acquired that firmness of texture, and that evolution of parts, which constitute the perfection of their natures, and enable them to produce beings every way similar to themselves. In both kingdoms, the age of puberty arrives later or more early, according to the difference of species. Some animals live a few months only. Many of the insect tribes are produced, grow to maturity, propagate their kind, and die, in the course of a single season. Others, as several flies, beetles, &c. exist two years. Thus animals have a progressive duration of life, The dormouse lives six years; the hare, seven or eight; the bear,

* Buffon.

twenty or thirty; the camel, forty or fifty; the rhinoceros, seventy or eighty; the elephant, two hundred; and some birds and fishes are supposed to exist during three or four centuries. The same progressive duration takes place among vegetables. Some plants are annual, as most of the esculent kinds. Others, as the hedge parsley, the wild carrot, the parsnip, the fox-glove, the scurvy grass, &c. are biennial; others exist three, five, seven, ten, twenty, thirty, sixty, and a hundred years. The oak, like the elephant, and those birds and fishes which are famed for longevity, continues to adorn the forest for several centuries.* A yew stood, a very few years ago, in the centre of the cloyster, near the great church at Perrone, in Picardy, which is mentioned in a grant dated in the year 660, and designed even then by the appellation of *the old yew tree.*† This makes it consequently upwards of one thousand years old, and gives room for conjecture, that it might considerably have exceeded the longest lived being we are acquainted with, even in the days of the antediluvian world. In this article of duration, as the lives of certain animals may be prolonged, or their deaths accelerated, so may those of plants, and this owing often

* Smellie. † Andrews's Anecdotes.

often more to the nature of the place, than to the nature of the being. In warm regions, plants that are annual with us, will become perennial or arborescent; and, on the contrary, cold regions will occasion perennial plants to become annual.*

Warmth and moisture are favourable to the production of large and juicy plants; and the animals that feed upon these succulent and rich vegetables, are likewise larger than those which inhabit cold countries, where the plants are smaller, more rigid, and contain fewer nutritive particles. Some plants grow in particular climates only. But, others, as several grasses, are diffused over almost the whole globe. In the same manner, some animals, as the camel, the rhinoceros, and the elephant, are produced in warm climates only; while others, as the reindeer, the glutton, and the marmot, are confined to the colder regions of the earth. But, man in the animal, like grass, in the vegetable kingdom, is universal, and inhabits every climate. Some plants, as well as some animals, are amphibious, as the rush and the frog; others are parasites, and feed on the juices they extract from different species to which they adhere.

* Linnæus.

The misletoe, for example, feeds upon the oak: most trees afford nourishment to certain mosses, and fungous plants; and every animal is fed upon by smaller kinds. But, exercise (do not be surprized at the assertion) is equally necessary to the vigour and health of plants, as it is to those of animals. The exercise of animals is effected by various kinds of spontaneous motion. Plants are likewise exercised by motion; but, that motion is not apparently voluntary; it is communicated to them by the action of the air. In a word, plants and animals are so nearly allied, that even some parts of animal bodies evidently partake of a vegetable nature. Thus, the hairs, the nails, the beaks, and the horns, are a species of vegetables, as appears from their comparative insensibility, as well as from the mode of their growth, and re-production.* But, that which is still more astonishing, the part which should seem the most remote from a vegetable nature, the medullary substance of the brain, is that which approaches nearest to the nature of a vegetable, in the air which it yields, when dissolved in spirit of nitre.† Aristotle, in opposition to the stoics, asserted that plants had souls, endued with vegetative

* Smellie. † Priestley.

getative powers. Are we to assert, that we have plants or vegetable substances, endued with intellectual ability?

Naturalists and anatomists, we thus find, have discovered analogies, or rather affinities, so strong between vegetables and animals in their structure, that they have fancied themselves warranted in classing them in one sole organic kingdom. Nor have chymists discovered less affinities in their properties. In the analyzation of their substances, they have found a positive resemblance, if not an identity of juices.* The extravagancies, however, to which such discoveries have carried some able and celebrated men, as well as others less inquisitive and less penetrating, we have already had occasion to touch upon. Ignorance might fancy the hair of a horse's tail to be transformed into an eel in water. But, the transmutation of an animal into a vegetable, or of a vegetable into an animal, could only be conceived by philosophers of peculiar acuteness of investigation. Needham was the first naturalist of this country who advanced the hypothesis, that vegetables did undergo such transmutation. But, as I shall have

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occasion afterwards to enter more fully into a subject so very fertile, I shall at present confine myself merely to the remark, that since experiment has succeeded to conjecture, and observation grown more correct, as to the origin of animated beings, the supposition that the filaments discernible in infusions, are actuated by an internal expansive spirit, and ultimately combine into microscopic animalcula, is not philosophically accurate or demonstrable. On the contrary, after a series of the most diligent and indefatigable researches, it has been ascertained, that animalcula are frequently in existence before filaments; that they are to be seen in infusions which never produce filaments, or in other words, any mould; and that filaments are to be found where there never are animalcula.*

The essential causes of life, and of animal motion, are indeed inscrutable. The elastic fluid of light and fire, however, has always been looked upon as a principal one. This, by the rapidity of its motion, and by its breaking the union of the various parts of matter, renders those parts again fit to unite with other bodies, and

* Spallanzani.

and in other modes. And hence, it is said, the seminal power in the seed attracts to itself such particles, as are fit for its increase and nourishment. There are vegetable substances, no doubt, wherein the pabulum of fire is contained at rest, as in oils, sulphurs, bitumens, wood, &c. and this pabulum may be considered as a congeries of imprisoned rays or particles of light. But, though these may operate strongly towards the common purposes of vegetation; and though light touching upon a flower or a leaf, may send forth odour and colour; it yet is not decided, what these odorific and colouring particles are, and whether it be the combination of a portion of this fluid with the humours of the vegetables which afford them; much less, what are the primary causes of vitality. As to motion, we are indeed told, that animals, in comparison to vegetables, are generally found to possess a greater proportion of volatile parts; fewer of acid; and considerably less of alkaline. And thus is seen the reason why animals are alert, prompt, vigilant, active, and abounding in motion, while vegetables and minerals are stupid and stationary. For is not an acid, it is asked, styptical, coagulent, a compressor, and an astringent, as is observed in the cases of paralytic affections? In addition to this, also, are we not to take into

the account the surcharge of humidity, for spirit is the balm and the life of animated nature? An animal with a superabundance of fluid, is evidently heavy, inactive, and sleepy. A vegetable, likewise, in the same state, is drooping, and tending to extinction. And are not the vivacious, in consequence, those who are dry, and who are spiritous? *

It would not be easy to find reasoning much more wild and chimerical than this. At the same time, experiment seems to warrant the conclusion, that the electric fluid, or fire, has a paramount influence on life, animal motion, and the phænomena of vegetation. Electricity, as we have already frequently observed, is probably the prime vehicle of our finest feelings, of the sensibility of our nerves, and of our best material sensations. Its vivifying power on both animated and vegetable nature, is too strong and apparent to be doubted. And what is this electric fluid, perhaps, but the solar rays, arrested, modified, and returned by the earth? Anaxagoras, under the name of æther, looked up to it, as to the great agent of all things. The higher parts of the world, says he, are full of fire, and the power that is there is æther. Light-

* Nature Devoilè.

Lightning is distilled from this æther. Thunder is caused by its falling upon the ærial regions. The meteors of it, that shoot down in sparks, are quickly absorbed. * Zeno held the first element to be this fluid fire, which, as all bodies tend to the centre, inclines as much as the levity of its nature will admit, to the centre of the world, by a circular motion around it. † That the element of fire is universal in its agency, through all the kingdoms of nature, we have already shewn in many preceding discussions. The shapes in which it manifests itself, are various. Phlogiston has been supposed one; but the existence of this chymical element is now denied, though the difficulties are many, which attend the consideration of chymical facts without it. When in combination (for I, for one, admit of its existence) it may be let loose by various methods. Having recovered its elasticity, and gained an aerial form, by a proper addition of specific heat, it receives the name of inflammable air. Æther, converted into a vapour in a vacuum, gives a permanently elastic vapour, which is inflammable. Scheele was of opinion, that every inflammable air, was composed of a very subtile oil. And this coincides with the idea entertained by chymists, of phlogiston;

* Plutarch. † Stœbeus.

giston; and is confirmed by the fact, of its being naturally found in the springs whence petroleum issues, whose exhalations are inflammable.*

Doctor Crawford, on the contrary, says, that bodies which contain a large proportion of phlogiston, as vegetables certainly do, possess but a small share of specific heat or fire; on the contrary, that those with a great share of specific heat, contain but little phlogiston; and finally, that those which are deprived of phlogiston, increase their capacity for a greater share of specific fire. Thus, fire and phlogiston, in his hypothesis, are distinct and incompatible substances; so that when one enters into the composition of any body, the other of course is expelled from it. Thus metals may be calcined in consequence of a double attraction, by which the metal imparts its phlogiston to the air, while the air communicates its fire to the metallic calces; which may be further confirmed by the air that is found in metallic calces, whose increased weight by calcination, corresponds to the air that is expelled from them by their reduction to a metallic form. Phlogisticated air, in course it is contended, has very little specific fire;

* Magellan.

fire; common air has more of it; and dephlogisticated air, shews a prodigious quantity of fire. Every idea of phlogiston is, however, for the moment, you know, exploded by celebrated chymists of our own country, as well as by those of France. Whether, then, the nature of heat be a substance, or a quality, it is not our business in this place to re-consider. This, however, is clear, that supposing it to be a quality, difficulties insurmountable present themselves; whereas, allowing it to be a distinct substance, or an element *sui generis*, as we have all along conceived it, every phænomenon will admit of an easy and obvious interpretation.

This element of fire, so essential to vegetation, is yet not the only one which is required for the evolution and growth of vegetables. Water and air, are equally necessary. Of the supposed composition of water, we have already spoken. M. Volta, many years ago, discovered, that when inflammable air and dephlogisticated air were burned together, water was the residuum. Mr. Cavendish and others, to their own satisfaction, on repeating the experiment, ascertained the fact. But, it is asked, did these gentlemen ever purify these airs from the watery vapours they might have contained? Is

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it not the aggregate of these vapours which produces the water, they find afterwards? Mr. Cavendish says, that pure, or dephlogisticated air, is water deprived of its phlogiston; and that water is pure air united with phlogiston. But, can pure air be fire and water at the same time? I ask this question, because flame, heat, and light are said to arise according to the rapidity of the decomposition of pure or dephlogisticated air. On the contrary, Mr. Watt conceives, that water is composed of dephlogisticated air and phlogiston, deprived of great part of its elementary fire; and that dephlogisticated air, is water united to a great quantity of elementary fire, and deprived of its phlogiston. Besides these, M. de la Metherie holds, that the water produced by the combustion of these two airs, is contained in them both. Priestley, indeed, also leans to the same opinion. "That a considerable quantity of water," says he, "enters into the composition of dephlogisticated air, will not be thought improbable, when it is considered, that in my former experiments, this appeared to be the case with respect to inflammable air: for without water, this air cannot be procured. I can also now say, that the same is the case, with respect to fixed air. It is not, therefore, improbable, that the same may be

true,

true, of every other kind of air, since water is used in the production of them all. Hence, consequently, water may be supposed the *basis* of them all; and hence it is unnecessary to suppose, as myself, as well as others, have done, that water consists of dephlogisticated and inflammable airs, or that it has ever been either composed or decomposed in any of our processes."*

In an early period of our correspondence, I hinted to you the doubts which hung upon the aerial formation of water. Experiments, however, then had not been so satisfactorily made as they have been since. The present brief review, therefore, will not, I hope, be tiresome to you; and more especially, as you will perceive, that the vegetable kingdom, of which we are treating, could not have existed without the element of water. If a mixture, it has been said, of about two parts by measure of inflammable, with one of vital air, be set on fire in a strong closed vessel, which may be done by the electric spark, the airs, if pure, will almost totally disappear, and the product will be water and an acid. Till of late, this product was thought to be mere water; and several eminent chy-

* Priestley.

chymists strongly maintained that it was equal in weight to the two airs made use of. This point, however, has certainly not been proved; and as every kind of air usually holds a large proportion of water in solution, from which the aqueous product may be derived, it still remains a problem to be decided, whether water, with respect to the present state of our knowledge, be a simple, or a compound substance: for the water may be formed, either by the union of the two airs; or the real airs may be totally employed in forming the acid, while the water is simply condensed upon their losing the aerial form.*

There is a beautiful simplicity in the system, which makes the different kinds of air, and the atmosphere of the earth and other planets, the mere union of heat with different substances, which serve as bases to it; and which explains how all bodies, whatever, become airs, when united with a certain quantity of heat only; and how these airs are decomposed by the separation of the heat, and the re-union of the particles of the bases with one another, or with other bodies. But, is all this absolutely demonstrated; or is it not

* Nicholson.

not partly hypothetical? May not two general fluids, vapour and air, be here confounded? Is the vapour of boiling water, or the vapour into which any known substance is resolved by the mere union of heat with it, really and truly aeriform, that is, permanently elastic? Or may it not be probable, that water is a component part of many species, if not of every species of air, but, that it never can become aeriform, without the concurrence of some principle or principles besides heat? Moreover, when we are told, that the bases of vital air and inflammable air uniting, compose water, may we not conclude, that the inflammable mixture of these two airs, in due proportion, is precisely of the same composition with the inflammable vapour of water, since the bases are, in both cases, united with the necessary quantity of heat, for rendering them aeriform? But, as it is not until after the actual inflammation of the airs, that any water is obtained from them, what is it that passes in that operation, whence proceeds the immense quantity of light that is emitted? Where was this light lodged, and what function did it perform, previous to its emission? Might not the principle of inflammability have made its escape with this light, instead of remaining behind to make a component part of the water?

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This combustion occasions difficulties: for if the light and heat do not proceed from the combustible body itself, but, from the decomposition of the vital air, whose concurrence is necessary in the process, then that air must contain both light and heat, as two distinct principles; for they can hardly be supposed the same thing, when it is known, that the one is transmitted through the glass, while the other remains behind. We are informed, that the mixture of vital and inflammable air, contains the principles of pure water, and of pure water only; and yet we find that the water obtained from them, is always accompanied with an acid.*

Having our aqueous element thus again, to my great satisfaction, even though conjecturally, restored to us, we can with more ease attend to the wonders of the different kingdoms of nature. Buffon would give to a red hot vitreous globe the powers of eventual animality and vegetation, and that without the essential germs, whence animality and vegetation could arise. Here, likewise, we were to have been deprived of an element, without which no terrestrial existences could have taken place. Animated, vegetable, even inanimated nature, perhaps, could

* Kerr.

could not have had consistency without water. In each, it may be styled a constituent part. Is it quite reasonable, therefore, to say, that this globe was ever divested of water? Men, beasts, birds, fishes, insects, and vegetables must have had the support of this element, or something like it, from the commencement of things; or men, beasts, birds, fishes, insects, and vegetables could not have been essentially what they now are. Moreover, whence all the inhabitants of the waters, who, in number and variety, greatly, it is to be presumed, exceed those of the dry land? Could the whale roll in the expanse of the atmosphere, while the medium destined to its future abode was still in aerial supension? Could the animation of the ocean have been upheld in these supposed original aeriform materials, of which water hath since been composed?

Desarts, it is said, are to the habitable parts of the earth, what openings and squares are to large cities: they are designed to preserve the air in a state of purity, which it would probably lose, were every part to be equally inhabited. Those vast beds of sand, which extend themselves from the further extremities of

* Plutarch.

Africa, to the centre of Asia, may, for aught I know, be thus beneficially arranged. But, would it be the same, were the tremendous caverns of the deep, to be emptied of the fluid of which they actually are charged, and which in surface surpasses the superficies of the dry land? But, we will not insist any more upon this subject, although it might be curious to observe, that Anaximenes taught that the clouds were formed by the condensation of air; rain, by the condensation of clouds; snow, by the congelation of rain in falling; and hail, of the same contracted by a cold wind: thus giving them, one and all, an aerial origin; making air the cause of every created being, and a self-existent divinity, and deriving the sun, moon, and stars from the earth: and this more than 2000 years ago.*

The family of vegetables, with whom we are now about to part, have shared, it is believed, the same fate with other classes of beings. Pliny mentions many plants, which are at this day unknown to us. The same has happened with respect to species of birds and of fishes, and, in all probability, of other animals also, man not

* Cicero. Pliny.

not excepted. In the heavens, stars, it is supposed, have disappeared. In our progress, hitherto, we have, not unpleasantly, been obliged to concede somewhat more than common vitality to the vegetable race. And in so doing, were it to afford no other satisfaction, it yet would, to a philosophic mind, yield this pleasing reflection, that the slaughter of animals for our tables, is not altogether so very cruel and wanton as has been imagined; for it proves that, all being animated, the fruit and the vegetable would cast upon us the same reproach with the sheep and the ox; and without one or the other, existence could not be preserved. The killing of an animal for food, cannot be more cruel than the tearing up of a root, or the pulling of an apricot.

Large animals, we have seen, constitute but a small part of life; the earth teems with the smaller tribes. Every plant, every grain, every particle of organized matter, contains millions of animated beings. If incredible numbers of these were not to be devoured by other animals, what would be the effect of such an amazing multiplication? From their numbers, they would soon injure and destroy each other. For want of sufficient nourishment, their fecundity

would diminish. Contagion and famine would produce the same effects, as the present consumption. Thus the different species must of necessity prey upon each other: and hence the killing of animals is both a lawful and an innocent practice, because it is founded in nature, and they hold their existence under that seemingly hard condition.* In like manner, with regard to plants: no objection to the animality of vegetables can be brought from any consideration respecting their daily destruction; for the destruction of animals by other animals, the *bellum omnium in omnia*, is an universal law of nature, derived from the same Benevolence, to which we attribute creation itself. The animals, men, beasts, birds, fishes, and insects, live upon vegetables; and the animal vegetables, live upon men, beasts, birds, fishes, and insects, in their nutritive state of dissolution. Thus it is by death, and seeming imperfection in his workmanship, that the Deity preserves vegetable life; supports the animal kingdom; daily regulates and renews the œconomy of nature; and continues this wonderful system of things in full youth and vigour, not interrupted by disease, nor enfeebled by old age.†

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* Buffon. † Bishop Watson.

One word more, and I have done. The real value of individual enquiries is, that they eventually tend to general utility. All trees, says an ingenious and respectable botanist, * which bear stone fruits, are liable to emit a gum, that by producing a canker, grows fatal to the health and vegetation of the trees. Most forest trees, are also liable to what is called bleeding, which proceeds from any injuries, that obstruct the circulation of the juices. Some are injured by unskilful pruning, and lopping at improper seasons of the year; and others by the violence of high winds, having boughs, or limbs, torn from their bodies, which being left in that state, exposed to all the inclemency of hard frosts, are often cracked or rent in the wood, or being wasted and soaked by rains, the wounds imbibe so large a quantity of moisture, as by causing a fermentation with the natural juices, brings on diseases, and destroys the health and vegetation of the tree.

The cure for trees of all denominations, is applied in the manner of a plaister, to the wounded or injured part. It is of a soft and healing nature, possesses an absorbent and adhesive quality, and by resisting the force of

* Mr. Forsyth.

washing rains, the contraction of nipping frosts, and the effects of a warm sun or drying winds, excludes the pernicious influence of a changeable atmosphere. The general practice has been, to lop trees, or prune them, from the month of October, when the juices have been exhausted by the summer foliage, autumnal fruit, and general nourishment of the body of the tree, until the month of March, when the sap or juices begin to re-ascend. But, trees of all kinds, whether in gardens or orchards, in parks or forests, may with greater safety and advantage be pruned or lopped in the spring, or early in the summer, than in the winter season: for the flow of the juices will be repelled; a more active vegetation will be caused; and nature will be more powerfully assisted in healing the wound, at the time the sap is in full vigour, than when it is on the decline, as in summer and winter.

The best method of treating them, is the following. They should be headed down with a saw, and the place at which they are cut should be smoothed, either with a draw-knife, a chissel, or large garden knife, gradually sloping the edges of the bark home to the wood. Great care

care should also be taken, to cut the stem or branches, as near as possible to some of the last year's shoots or buds, if there be any; as the application of the plaister will increase the vigour of such shoots, and force them to cover the place. Apple trees are very liable to the canker. All the infected wood, should be cut clear away. Plumb trees, and cherry trees also. The liver-wort, and other mosses, that infect fruit and forest trees, should be cleared away from the bark. All forest trees should be cut, whether with a saw or an axe, near to the ground; at the same time, carefully preserving the stump and roots from any further injury. The surface should be then smoothed, rounded in a small degree, and covered with the plaister, but which, in this instance, must have an equal quantity of alabaster powder, mixed with the dry powder, generally directed to be used after the plaister is laid on, in order to render the surface harder. But, this is by no means necessary, in the usual application to the sides of trees. The shoots from trees, so cut down, will be vigorous and luxuriant, and will amply repay the expence of the treatment.

In pruning of fruit trees, it would be well for the pruner to carry a small box of the composition about him, and rub a little of the plaister on every wound made by his knife. The vegetation would be healthier, and the size and flavour of the fruit would be increased. For the application, take one bushel of fresh cow dung, half a bushel of lime rubbish of old buildings; that from the cielings of rooms is best; half a bushel of wood ashes; and a sixteenth part of a bushel of pit, or river sand. The three last articles are to be sifted fine before they are mixed. Then work them well together with a spade, and afterwards with a wooden beater, until the stuff is very smooth, like fine plaister, used for the cielings of rooms. All dead, decayed wood, must be carefully cut away. The compound must be laid on the fresh, sound wood. The plaister must be about one eighth of an inch thick; the edges finished off as thin as possible. Then take a quantity of dry powder of wood ashes, mixed with a sixth part of the same quantity of the ashes of burnt bones; put it into a tin box, with holes in the top, and shake the powder on the surface of the plaister, till the whole is covered over with it; then apply more powder, till the whole

whole plaister becomes a dry smooth surface. When lime rubbish of old buildings cannot be easily got, take pounded chalk, or common lime, after having been slacked a month at least. As the growth of the tree will gradually affect the plaister, by raising up its edge next the bark, care should be taken, when that happens, to rub it over with the finger, when occasion may require, which is best done, when moistened by rain, that the plaister may be kept whole, to prevent the air and wet from penetrating into the wood.

LET-

LETTER LXI.

DESTRUCTION, is necessary to life. It is only from the destruction of each other, that animals and vegetables exist and multiply. The total quantity of life, remains always the same. Death, who would seem an universal destroyer, annihilates no part of that primitive vitality, which is common to all organized beings. He attacks individuals; he spares the species. He crushes the form; but has no influence on the matter. In all the operations of nature, indeed, it evidently appears, there reigns a greater predilection for life, than for death. An unwearied, and incessant production of organized bodies is manifest every where. Even we ourselves can increase at pleasure the number of vegetables and animals; but, we cannot augment the quantity of stones, or of inert matter. Does not this indicate the most ordinary and familiar operation of nature, to be the production of bodies with the functions of life and ani-

animation? * The prime object is, the production and preservation of existence in general, in the utmost extent and variety. All second causes are, by immutable laws, rendered subservient to this purpose. If the species multiply, it is in order to repair the losses to which their frailty exposes them; if they destroy each other, or if the term of their existence be confined, it is to prevent their increase from becoming excessive.

The beings of this world act one upon another, not by a blind and fortuitous energy, but, by constant and undeviating laws. And who can sufficiently admire and praise the amazing benevolence of the Maker of all things, in his vouchsafing to make such provision for continuing and supporting the animal and vegetable parts of the creation in a series of uninterrupted succession? But, how is the mystery of propagation to be explained? Some have had recourse to an indefinite divisibility of matter; supposing that all the infinite individuals of every species, were actually contained in the first original seed. But, in what manner can they imagine such infinitely impregnated original seeds to have first come into existence? Or how

* Buffon.

how comes such an infinite number of animals to issue from one imperceptible germ? To begin, however, in order. The word generation we will, if you please, omit, as it implies, the giving being to animals and vegetables, or their first creation. Γενεσις is to be distinguished as the work of the Omnipotent alone, at his first almighty fiat. Propagation is the word which will best serve our purpose, as it merely implies a successive multiplication and increase, after the original incomprehensible creation.* In a general view of things, we are incompetent to conceive how any thing but impulse of body, can move body. Yet my right hand writes, while my left hand is still: what is it, which causes rest in the one, and motion in the other? Nothing but my will, a thought of my mind: my thought only changing, the right hand rests, and the left moves. This is matter of fact, which cannot be denied. Can we explain this, and make it intelligible? † On material principles, we cannot. What are we then to say of creation, or even of the propagation of the various organic beings of the earth?

Our knowledge is narrow. He who knows any thing, knows, in the first instance, that he needs

* Parsons. † Locke.

needs not seek long for proofs of his ignorance. The meanest and most obvious things that come in our way, have dark sides, which the quickest sight cannot penetrate. The clearest and most enlarged understandings of thinking men, find themselves perplexed and at a loss in every particle of matter. What is that plastic power in nature, which forms and gives existence to the embryo? Matter cannot be supposed its own formatrix, to modify itself into all the forms that appear to our senses in every animal and vegetable being whatsoever. But, let us reflect, that if there were a time when matter, or any part of it, was unformed, it must be supposed to have been inactive and at rest at that time; and if it be said, that this matter became active at any time to form itself, independently of a Supreme Being, then it must be supposed to have had a prescience of whatsoever different orders, situations, forms, motions, and qualities, would be necessary for the well being of the whole; for such a power, necessarily implies a previous design to form and dispose itself into every species of being that possibly can exist. And then, if this prescience be allowed to matter, it must be allowed, also, to have been eternal, because an exordium to prescience cannot be accounted for. For let

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me ask, what is prescience? Surely it must be answered, it can only be an *attribute* of some being. Of what being? Of matter, or of an Omnipotent Intelligent Being? Who can rationally refuse the latter? Or who can seriously imagine matter could have had existence at all, without the previous cogitation of the One All-powerful Mind? *

It is invention, it is said, which in different degrees distinguishes all real genius. The utmost stretch of human study, learning, and industry, which master every thing besides, can never attain this. It furnishes the best materials; and without it, judgment itself can at best but steal wisely, or at most, be conceived to live, by managing the riches of nature. Were it possible for us, however, to reach the truth in all sciences, we should, I am apprehensive, find that it has been the greatest men, who have wandered oftenest. The philosopher who states sentiments of his own, must necessarily be sometimes mistaken, and may be too often found to reason hypothetically. Yet, though the wanderings of the inventive and reflecting mind, do not, in every respect, merit approbation, they

* Parsons.

they nevertheless call for respect. The absurdities of the profound, are generally the results of thought and of courage: such men dare fly, when others scarcely creep.—Organic bodies, we are told, are nourished by the particles of aliment which they imbibe, and are similar to them; they grow, and are expanded by absorbing those organic particles; and they propagate, because they contain some organic particles, similar to themselves. Till his growth be completed, man, like other animals, has few or none of these superfluous particles. For this reason, he is incapable of propagating. When he has nearly attained his full size, he no longer wants the same quantity; the surplus is therefore sent from all parts into reservoirs destined for their reception. A little of the male fluid, meeting with the smallest drop of the female fluid, is sufficient for the purpose of propagation. Nay, so certain is it held, that the seminal fluid is formed by the surplus of the nutritive particles, that the condition of mutilated animals, is supposed to put it beyond all doubt. In this unnatural state they grow fat. The superabundance of nutriment, having no organs for its evacuation, changes the whole habit of the body. They increase in size; and generally

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in deformity. We are likewise told, that the destruction of organized bodies, is only a separation of the organic particles of which they are composed.*

The sameness of species, proves the sameness of atoms. This was a favourite doctrine of the father of the Epicurean sect. That there are atoms, says he, is evident; for seeing that nature makes nothing of nothing, and reduces nothing to nothing, there must remain in the dissolution of compound bodies, something that is incapable of farther dissolution.† If you say, that the elementary particles are still dissolvable, or divisible, it will be necessary, by subdividing, to come at last to something that is solid, and incapable of division; since neither nature herself dissolves things infinitely, but stays in some last thing, nor can bodies admit of an infinite division. Add, also, the divers sorts of constancy in nature, as in carrying on animals always to certain bounds of strength, augmentation, and life; in imprinting always the same distinctions, and marks of every particular kind; which she could not do if she did not use principles certain and constant, and therefore not obnoxious to dissolution

* Buffon. † Epicurus.

tion and mutation.* All that bodies differ in, is in qualities; which qualities, or figures, indeed, are, it must be confessed, incomprehensible.

The foundation of Buffon's system, on universal matter, generation, and nutrition, is to be found, in the doctrine which was held and taught by Anaxagoras, Empedocles, and others of the earliest philosophy. Diogenes Laertius, Aristotle, and Plutarch inform us, that Anaxagoras believed bodies to be composed of small similar, or homogeneous particles: that these particles, indeed, admitted a certain mixture of minute heterogeneous particles; but, that it was sufficient for the constitution of any particular species of body, to have the greater part of the particles of a similar or homogeneous nature, that is, of the nature of that particular species. Different bodies, he held to be different masses, of similar particles among themselves, but dissimilar as relative to others. For instance, the blood he believed to be formed of many molecules, or particles, each of which was blood; that a bone was formed of many little bones, whose extreme minuteness prevent-

* Lucretius.

ed their being observed: in a word, that imperceptible veins, arteries, nerves, muscles, &c. were derived to us from every grain of nutriment we received, whether animal or vegetable. This similarity of parts, he called ὁμοιομερείαι. Wherefore, according to this philosopher, there is neither generation nor corruption, properly speaking; neither birth nor death: the generation of each species, being nothing more than the assemblage of many constituent particles of that species, and the destruction, the dis-union of those particles: all which particles, invariably preserving a tendency to re-union, at length re-produce, by their junction, other bodies, each after its kind. *

Empedocles taught, that matter had an inherent and living force, a subtile and active fire, which gave motion to every thing; and which Buffon styles, organic matter always active, or organic animated matter: for fire, says he, converts almost every species of matter into its own substance: animals partake of the nature of flame; their internal heat is a species of fire approaching to flame. Empedocles had likewise a sentiment on generation, which Buffon has followed, and which he has expressed in almost

* Duten.

almost the very terms of his master, viz. That the seminal liquor of both sexes contain all the analogous molecules of the animal body, and are necessary to its re-production. "Empedocles, quidem divulsa esse sobolis membra aeiebat ut in fæminæ alia, alia in maris semine continerentur." In like manner, Anaxagoras has been followed, by the same naturalist, in the supposition, that there is in nature a common matter for animals and vegetables, and which serves for the nutrition and developement of all things that live or vegetate; and Plotinus in the doctrine, that the different parts of each animal have an attractive virtue, by means of which they appropriate such portions of the aliment as best accord with them. "Animalis quodlibet membrum habet vim ad attrahendam portionem propriam alimenti, venæ ad sanguinem; arteriæ ad spiritum; testiculi ad semen." With Anaxagoras, also, Buffon holds the non-existence of pre-existing germs, but, that there is an organic matter, always active, always ready to form itself in the internal mould; and that consequently, neither animals nor vegetables can ever be exhausted, and that there are as many at this hour, as there were at the beginning of the world. *

* Duten,

But, let us hear Buffon himself, on the subject of this ancient hypothesis. There exist in nature, says he, organic particles, every way similar to those large organized bodies, which are so conspicuous. These particles are *living*, and are the primary and incorruptible elements. They constitute the animal or vegetable; and consequently re-production is nothing but a change of form, effected solely by the addition of similar particles; and the death, or resolution of organized bodies, is nothing but a separation of the same particles. From these living, or organic particles, all animals and vegetables derive their origin. All animals and vegetables contain an infinite number of these particles; and most abundantly in their seeds, because their seed is an extract from all their organic parts. Nor are they different in the semen of the female, from the semen of the male; nor even in the seed of plants. These living beings, contained in the seminal fluid of both sexes, are not real animals, but, organized living molecules. But, why do I deny, says Buffon, it may be asked, these moving bodies to be animals, after they have been uniformly recognized as such by every man who has examined them? And how is it possible to conceive

ceive the nature of living organic particles, unless we allow them to be real animals? To suppose an animal to be composed of lesser animals, is nearly the same idea, as when one says, an organized body is composed of organic living particles. These are my answers, says he: Mr. Needham and myself have proved, by repeated experiments, that the moving bodies in the seminal fluid, are not real animals, but bodies more simple, and less organized than animals; the constituent particles, perhaps, of all animated bodies. Mites, and other animalcula, are totally different from these organic particles, which, when a great number of them unite, become perceptible by means of the microscope.*

The corruption and resolution of animals and vegetables, continues the same writer, produce an infinite variety of organized bodies: some of them, as the calmar, are only a kind of machines, which, though exceedingly simple, are very active. Others, as the spermatic animalcula, seem to imitate the movements of animals. Others resemble vegetables, in their manner of growth and expansion. There are others, as those of blighted wheat, which at pleasure can

* Buffon.

alternately be made to live or die. There are others, which are at first a kind of vegetables, then become a species of animals, and again return to their vegetable state. Thus, there unquestionably are several organized bodies, which we consider as real animals, but, which are not engendered by others of the same species. The eels, in paste; those in vinegar; and, in short, all the pretended microscopic animals, have no other origin than the union of the organic particles of the most essential part of the grain. To discover this, we have only to infuse animal or vegetable substances in water. The salts melt; the oils separate; and the organic particles become evident by their movement. The prolific matter first discovers itself under the form of vegetation. It forms into filaments, and expands; the extremities and joints swell, and burst, to give passage to the multitude of moving bodies, which have the semblance of animals. Nature, it would appear, begins all her motions by a kind of vegetable motion. The fætus, at first, only possesses a vegetable growth and motion; it breathes not, till it comes into the air.*

* Buffon.

Men,

Men, I am sorry to say it, by stepping beyond nature in their conjectures, often step beyond reason also. Thus, those who have deduced particles from all parts of the body, and assembled them in the testes of the males, and the mistaken testes of the females, eye particles from the eye; nose particles from the nose; and so on of the rest, to form the proles, have been extravagant. They did not reflect, that since it was necessary that particles should come specifically from every part to form a complete animal in the womb, it must necessarily follow, that the maimed or lame parent, should beget a maimed or lame child; a man, who had by accident lost a leg, arm, eye, or ear, should beget a child wanting these parts, and so on. But, we well know, the lame, the blind, and the earless, produce children perfect in all respects; and, on the contrary, that the best formed couples, often produce children imperfect and disfigured, which could not be the case, if such were the true system.*

Besides the *homoiomereiæ*, and the organic molecules, Hippocrates insinuates, that the semen of males is full of animalcula. Democritus talks of certain worms which assume the

* Parsons.

human figure; and Aristotle tells us, that the first men issued from the earth in the form of worms. At the same time, indeed, this latter, after the Pythagoreans, admits that the seminal liquor of both sexes, mixing together, contributes to the formation of the fætus; which fætus becomes either male or female, according to the greater abundance of the male or female organic molecules; and resembles either the father or mother, according to the different contributions of the two semen. "*Constat semen esse excrementum alimenti, quod ultimum in membra digeritur.*" But, the irrationality of this hypothesis is evident, as there is no given force, which can send the least particle into the fallopian tubes, the ingress of which into the uterus is so small, as to escape the most nice attention, and so contrived, as not to suffer perhaps even air to pass through it.

The most celebrated systems of propagation, however, I mean of our modern ones, may be reduced to two: the one attempts to explain the formation of animated beings *mechanically*; the other supposes them to be already formed, and *pre-existing*; and that the act of fecundation only unfolds them, and renders them visible. Those who favour this second system, are

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again divided into two parties, some being of opinion, that the fætus pre-exists in the female, and others, in the male. Old philosophers gave oviparous and viviparous birth to stones and minerals.

But, some modern philosophers cannot consider the formation of the fætus, or of the plant, as any thing else than a pure and absolute crystallization. Animals and vegetables, says one of these celebrated men, are produced by the crystallization of their seeds; and by the same power they are nourished, and increase in size.* This, you will say, is strange doctrine. A man and an oak, to be formed as a quartz, and a granite! The subject of propagation, is indeed intricate, and full of difficulty. Of all the arcana of nature, none are certainly more removed from the inquisitive and prying eyes of experimental investigation, than the generation and succession of animals and vegetables.

Aristotle, Averrhoes, Avicenna, and other philosophers, have endeavoured to prove that females have no prolific fluid: for, say they, if they have, why do they not produce without the

* De la Metherie.

the intercourse of the male? Others, again, such as Valisnieri, have concluded, that the work of generation is carried on in the female testicles; that the male seed ascends into the ovarium, penetrates the egg, and gives motion to the fætus, which previously existed in the egg. De Graaf says, viviparous females have eggs, in the ovaria, or testicles, but, that they cannot be separated till they are fecundated by the semen of the male. Malpighius reasoned nearly in the same way. Steno, Swammerdam, and Van Horn, ranged under similar arguments. The *vis plastica*, you thus see, has been tortured in various ways. It was played with from age to age, until the learned members of the Lyncean Academy in Italy began their deep researches into the works of nature. They began to reject all notions of spontaneous or equivocal generation. They began to consider the appearances in the spermatic substance of some animals they had examined, as eggs, whence the future animals were to come; and to establish certain points, which all tended to the same great truth, *omnia ex ovo*.

Harvey, from the labours of this society, first drew, it is probable, the idea of his system, for he was a student at Padua, about the time of

of the institution of the Lyncean Academy.* Not but that the same system is to be traced to a much earlier period. Empedocles, it is believed, taught it. Hippocrates, Aristotle, and others, adopted it in a great measure from him. Macrobius positively says, that the egg is the first principle of generation, in all animals that multiply from coition. *In omni genere animantium quæ ex coitione nascuntur, invenies ovum aliquorum esse principium instar elementi.*† Harvey's opinion, however, is, that all females are furnished with eggs, and that the embryos, or young animals, are formed in the same manner as a chicken in the egg of a bird. Generation, according to him, is effected wholly by means of the uterus or womb, which conceives the fætus by a kind of influence communicated to it by the male semen, much in the same way, as the load-stone communicates magnetism to iron. Nor does this influence, he thinks, act only on the uterus, but, is communicated to the whole body of the female, which is altogether prolific; though the uterus is the only part capable of conceiving the fætus, as the brain is the only part capable of conceiving ideas and intelligence.

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* Parsons. † Duten.

This at present generally received hypothesis, *omnia ex ovo*, had yet many opponents to encounter in the beginning. Leuwenhoek, Andry, and other celebrated philosophers, exerted every effort against the egg system. They fancied they discovered in the semen of the males, the animalcula. They contended the females had none, and that they derived their fecundity solely from the males. In short, according to their system, it was not the first woman, but, the first man, who contained all mankind in his body. Spermatic animals, it is certain, are in incredible numbers in the semen of males. They are of different figures, in different animals, and have commonly a circular motion: but, they are all long, says Buffon, thin, without any members, and move with rapidity. Andry goes farther, and says, the spermatic animalcula are to be found in the human semen, when arrived at the age of puberty, but, never previous to it; that they do not exist in the semen of old men; very few, when the habit is affected by the venereal disease: but, that none alive have ever been traced in impotent persons.

The system of eggs, it is confidently asserted, explains nothing, and has no foundation in na-

nature.* But, those who say so, and who consider organic molecules, or the more specious idea of spermatic worms, as the immediate cause of generation, must they not of necessity suppose, that they exist in the seed, whenever fecundation takes place? And, on the contrary, that the seminal fluid must be unprolific, when it is totatally destitute of inhabitants? Its advocates, indeeed, admit this. But then, what they admit does not agree with fact. In the seed of animals, it is true, *vermiculæ* may generally be observed, yet, in that of toads, in an experiment made by Spallanzani, they were entirely wanting; and, notwithstanding this, the semen generated tadpoles, in as complete a manner as the fluid of other individuals, though abundantly peopled. I have frequently proved, says this great naturalist, when the seed of the frog or toad was mixed in equal quantity with human urine or vinegar, which destroyed all the worms, that the semen, notwithstanding, did not lose its prolific power.

The rudiments of all animals are formed in the ovum. The fecundation of the ova, is in the ovaria, and this, as I have already said, not from

* Buffon.

from any gross seminal matter, for such cannot insinuate itself. But, can it then be from spermatic worms? If the vehicle, in which such worms swim, cannot pass, how are we to conceive the worms themselves can reach the ovarium? Or, if they can reach it, by what mechanism can they be supposed to penetrate the ova, and not lose the inclosed fluid? Every animal, as every vegetable, at its creation, was made capable of bringing forth its offspring, according to its kind, in a successive series. The mystery of propagation, is best reasoned upon from analogy. Eggs, and seeds, are what we see animals and vegetables grow from before our eyes. But, eggs, it is said, instead of being common to all females, are only instruments employed by nature, for supplying the place of uteri, in those animals which are deprived of this organ: the egg, in oviparous animals, answering the same purpose as the uterus, and menstrual flux in the viviparous.†

Those diminutive beings, which inhabit the seminal fluid, have thus been more signalized by the disputes and theories of men of science, than any of the larger animals of the earth. But, this microscopic world in infusions, affords ovi-

† Buffon.

oviparous, as well as viviparous individuals. In all, multiplication is exceedingly rapid. A single individual soon produces an offspring too numerous to be counted; and the quantity in a short time surpasses not only belief, but imagination. Their number, says Spallanzani, exceeds that of the integrant parts of the fluid. All putrifying substances, and water of every kind, contain inconceivable multitudes. Every drop is peopled with myriads. The means by which they sustain life, furnish an amusing part of their history. Some excite an eddy, by moving rapidly the filaments which are placed round the opening of the mouth, and thus draw towards them the particles of food that float in the liquor. Others, with all the ferociousness of rapacious animals, pursue their weaker fellows, and devour them. In short, they manifest all the powers and vigour of larger animals.*

These animalcula in animal and vegetable infusions, we have already seen denied to be the offspring of parents of the same kind, but, to be the productions of a certain active force, with which every microscopical point of animal and vegetable life is endued. The substance

* Spallanzani.

stance employed in these effusions, says Needham, first, by its own innate energy, divides itself into filaments, and then vegetates into numberless zoophytes, from which proceed all the different species of microscopical animals: these animals, after a certain time, become motionless, and subside to the bottom, where they are resolved into a gelatinous and filamentous substance, which shoots into new zoophytes, yielding animals of a lesser species. As proof of this, observe, says he, the appearances in the infusion of a grain of wheat, where the seed is observed exercising this productive force, by vegetating into numerous stems, crowned with heads, bursting, as it were, into life, and throwing out their animal progeny. To this operation, the pushing forth of new shoots succeeds, and the forming of new heads, for the production of another generation.

These filaments and stems, however, the supposed vegetable parents of animalcular race, Ellis affirms, after a careful scrutiny with the best glasses, to be nothing else than the roots and stalks of that class of *fungi* called mucor, or mouldiness, vegetating in the infusion, and the growth of which is so amazingly quick, that the plants may be perceived in the microscope, even

even to grow and seed under the eye of the observer. Their stems terminate each in an oblong seed vessel; from a hole in the top of which, he has plainly seen their numerous and minute globular seeds propagated, and afterwards turning about in the water, as if they were animated. But, this last motion, he affirms, is owing to myriads of the minutest animalcula contained in the putrid water, and attacking the seeds of the mucor for food. Hence it is to be inferred, that the infused vegetable substance, is not the parent, but the pabulum, or nidus, both of the mucor, and of the small microscopic fry, whom Needham's theory would deprive of the honour of animal parentage: and the pre-existent germs, or the seminal system, may yet stand their ground against the active forces of Needham, and the organic molecules of Buffon. Nothing can reconcile the doctrine, that beings endued with spontaneous motion, many of them most curiously organized, can be produced by the mere energy and activity of the minute particles of vegetable and animal nature in a state of decomposition.

But, from what are organizations produced? When an animal and a tree is complete in

growth in every organ, (for after its completion it may grow larger, though not more perfect) the female then, and not before, is capable of producing its ova, or seeds from the ovaria. No formation of organic particles takes place, either in the animal or vegetable kingdoms. The order of fætuses which annually make their appearance in the ovaria, are not successively generated, but, co-existed with the female, and are only unfolded and rendered visible in progress of time, by the supplies of nutritive liquor that come from the female. The existence of the germ in the female before fecundation, is one of the most general laws of nature. In birds, the young exists in the female before fecundation.* The fætus pre-exists, both in the class of hot and of cold blood animals, such as the frog, toad, &c. The embryos of plants exist in like manner in the ovarium before fecundation. And this is analogous to tadpoles, who have at first no legs. Shall we therefore conclude, they do not exist at first, but are generated when the tadpoles approach their metamorphosis? Is it not infinitely more philosophical to suppose, that the limbs co-exist with the tadpoles, and are invisible, only because they are too small to strike the

* Bonnet. Haller.

the senses? And if it be reasonable to adopt this opinion concerning the limbs, shall we not also admit it with respect to the fœtuses of animals? We know that many insects pass through the three different states of worm, nymph, and winged animal; but, these different states do not constitute three distinct animals; it is the same animal that assumes these various appearances; so that the insect equipped with wings, existed under the membranes of the worm and nymph, from which, when it is freed, it issues forth, in a state of complete evolution. Swammerdam observes, that what the nymph is to the winged insect, the tadpole is to the frog; for he found the frog in miniature, under the disguise of the tadpole, and the winged insect, under the corn of the nymph. Should it, however, be suggested, that the gills and tail of the tadpole are not to be found in the frog, and that the frog has four legs, while the tadpole has at first none; let it be remembered, that the chicken, at its first appearance within the egg, has the shape of a worm, with a large head and long tail; that the heart has afterwards the form of a half ring; that incubation continues some time before the legs and wings shoot, and that it loses

the umbilical chord, when it breaks the egg. This Haller has proved. But, notwithstanding all these appearances of metamorphosis, no one, I believe, has ever imagined the pullet in the egg, and the hen to be different animals.*

The manner, indeed, of the impregnation of the original organization of either animal or vegetable, that is, how they are affected by the effluvia from the male seminal substances, an effluvium capable of penetrating the whole substance, (the notion that the germ is an adventitious body arriving at the ovarium, being ridiculous) must ever remain mysterious. A refined fluid, from the seminal matter of the male, impregnates the organization in the ovum in the female, mingles with the subtile fluids contained in it, and promotes its growth and progress. So in vegetables, the refined part of the pulpy fluid, thrown out from the globules of farina, mixes with the juices, and impregnates the little organization in the seed of every plant. Men and women, also, we find, after coition, though of different colours, yet produce, because it is ordained their innate juices should have a perfect agreement. Consequently their proles are capable of further propagation,

* Spallanzani.

tion, with any others of the human race. With the proles of different species of animals, it is otherwise. They cannot propagate, because the impregnating effluvia, the seminal matter of the male, is so much degenerated, by the unnatural mixtures of the parents, from any homogeniety with the particles of the innate juices of the organization in the ovum of its female, that instead of that agreement which causes fecundation, the ova are left incapable of ever coming to any thing.

It is held, however, that fætuses are not generated during the act of fecundation, but, that they pre-exist, and are contained within the female; and those who maintain it, have explained their animation, by imagining that the seed of the male enters into the fætus, and reaches the heart. By gently irritating the cavities of this organ, it excites alternate dilatation and contraction, and thus the fluids are forcibly impelled into their respective vessels. Hence an universal expansion of the solids, and consequently the growth of the animal. This is the doctrine of Vallisneri, Haller, Bonnet, and Spallanzani; and it is founded on the fact, that there is an evident pulsation of the heart, previous to the least motion in any of the

limbs; that there is the evolution of the vessels and of the whole animal which is consequent upon the action of this muscle; that there is irritability; and that there is that property, by virtue of which it resumes motion, when stimulated by any mechanical agent, and at a time, when there are no remains of irritability in the other muscles.

If it be asked, how a portion of semen, so infinitely small, can make such an impression upon the heart, as to accelerate its pulsations, quicken the motion of the fluids, and animate the whole system? It may be replied, there are not wanting examples in the animal kingdom, to give countenance to such a supposition. A drop of the poison of a viper, introduced into a wound, is sufficient to destroy the irritability of the muscular, and the sensibility of the nervous system, and to cause the death of any animal whatever, great or small.* If we consider, therefore, for a moment, the proportion between the bulk of the venom, and that of an ox or horse, we shall not be less surprized, that so small a quantity of poison, should be fatal to these great animals, than that so minute a portion of seed should animate one infi-

* Reaumur.

infinitely smaller. What the quantity necessary, however, may be, is not to be conjectured. Nature may allot various quantities of seed for fecundation, according to various qualities of animals.*

The male seed, according to Bonnet, is not only the stimulant, but, the nutriment of the fætus. The proof of his opinion is this. The organ of the voice in that mule, says he, which is the product of the mare impregnated by the ass, very closely resembles that of the male parent. If the germ exist in the female before impregnation, it must have been a horse in miniature, and not a mule or an ass; the organ of the voice, therefore, ought to correspond to that of the horse, and not of the ass. The seed must, then, have modified the organ of the voice in the germ according to that of the male parent. In conformity with this model, the parts of this organ grow and are unfolded; yet, we know the ass only contributed a fluid. The great naturalist of Geneva, also, strengthens his deduction by the instances of the growth of the beard in man; of the crest of the cock; and the horns of the stag, which are certainly owing to the efficacy of the seed. Haller, it

* Spallanzani.

is true, only agrees in part with Bonnet. He allows that these phænomena depend upon the seed, not, indeed, as a nutritive liquor, but, as an impelling or stimulative principle. I can never assign, says Spallanzani, to the seminal liquor, any other quality than that of a stimulant.

Whether the gross, visible part of the seed, be necessary to the fecundation of animals and man, or whether the invisible attenuated part, usually called the seminal vapour or *aura*, be destined for this purpose, is a very ancient question, and still continues to be debated. Those who favour the latter opinion, are obliged to maintain it from a sort of apparent necessity, rather than by any direct arguments or experiments. They observe, that the *vagina* of some pregnant women is either very narrow, or entirely closed; that at the time of impregnation, the seed does not reach the uterus; and lastly, that the fallopian tubes are so narrow, that they will not admit air, much less a dense substance. They conclude, therefore, that so many obstacles must prevent the seed injected into the female organs, from arriving at the ovarium, where the embryos are lodged. And hence they imagine, that fecundation must

be

be effected by the volatile part of that liquor, which either reaches the ovarium by the way of circulation, or by rising through the mouth of the uterus, and along the tubes. Notwithstanding these arguments, many authors adopt the opposite opinion. They think the gross part of the seed operates the impregnation, since the narrow passages are enlarged during the ardour of enjoyment; and since there are not wanting instances, where seed has been found in the uterus, in the tubes, and even to have ascended as high as the ovaria.

But, neither of these hypotheses is sufficiently established, to become the foundation of a system. The first, because it does not irrefragably prove, that the volatile vapour, the *aura seminalis*, the subtile spirit alone, reaches the ovaria; and the latter, because, though the gross parts should arrive there, it still remains doubtful whether the animation of the embryo is effected by this, or the attenuated part. Some experiments, however, on the toad and frog, shew that fecundation is not the effect of the *aura*, but, of the gross part of the seed. But, are we to conclude that nature observes this rule in other animals, and in man? Sound logic does not allow us to deduce from so few facts, a con-

conclusion so general. But, these facts, says Spallanzani, lead us to think the supposition probable. It is at least certain, that we may venture to admit it, till contrary facts shall be adduced; and thus the great question, whether fecundation be the effect of the *aura seminalis*, is clearly decided in the negative, with respect to some animals; and with probability, with respect to the rest.*

The mode of propagation in warm, and in cold blooded animals; in those who are fecundated internally, and those who are fecundated externally; in those who produce from coition, and those who have no intimate intercourse whatever, must certainly be essentially different. The impregnation of the toad, and of the human species, cannot be one and the same. It is probably in the animal, as in the mineral kingdom, where nature evidently employs different means, to accomplish similar ends: by fire she makes glass; by water she makes crystals; and the diamond, probably, by some other medium; yet, they are all in appearance of the same family. There are animals, such as the frog, with whom the fecundation of the eggs does not take place within, but without the

* Spallanzani,

the body. Whence it appears how far Linnæus was mistaken, when he pronounced, "*Nullam in rerum natura, in ullo vivente corpore fieri fecundationem, vel ovi impregnationem, extra corpus matris.*" The same, it is supposed, is the case with various fishes. Among bees, it seems to be established with certainty. Among all, however, the aspersion of the seed of the male, is necessary to the animation and evolution of the fætus. But, in reality, are these eggs, in the proper sense of the term? And is it not improper to name any body an egg, which, however closely it may resemble one in form, takes the shape of an animal without leaving any shell, as is the case with all animals that come unequivocally from an egg? All viviparous animals have this in common, that their fætuses are fully formed at birth, and retain the lineaments, which they then have through life: they are only more unfolded. We are further certain, that they have, long before birth, the form of the species, as is evident from human abortions, as well as those of quadrupeds. In like manner oviparous animals are formed, not only when they are hatched, but long before, as we see in the eggs of birds, and of various reptiles.*

Your

* Spallanzani

Your doubts, says Bonnet to Spallanzani, with respect to the manner in which the impregnation of fishes is effected, are well founded. We know, at least, from the experiments of Jacobi, that simple dispersion in water, is sufficient for the impregnation of the eggs. Small pores are discovered in the cover of the embryo, contrived for the introduction of the semen. The cover is absolutely perforated like a sieve. But, the question is, whether such apertures exist in the covers of the embryos of every species? Spallanzani does not hesitate in belief, on this question, that if the germ of the pullet, of the lamb, and of the calf, were as perceptible as the tadpole, we should detect absorbent pores, similar or analogous to those in the embryo of the amphibia. These absorbent pores, and their dependencies, says he, contain, without doubt, anatomical peculiarities, which we should admire, if we were permitted to develope the mystery. Each pore may be the orifice of a vessel, communicating with the heart.

Buffon and others, as I have above said, make impregnation always to depend upon the union of the organized particles in the seminal fluid

fluid of both sexes meeting in the uterus. They refuse access to the fluid to the minute ovum, through the aperture of the tubes. If these particles in the seminal fluid of the male, travel as they say, by absorption through the body of the uterus, it will be to little purpose if those furnished by the reservoirs of the ovaria have travelled by mistake into the huge capacity of the abdomen; a circumstance which sometimes does happen; and in which nidus, the fætus is as effectually evolved and maturated, as it might have been in its natural receptacles. But, as they confer powers on their living organic molecules, and take them away as best suit their necessities; sometimes giving them volition and a tail, and sometimes depriving them of life, and even decaudating them; who knows but they might in time have discovered an apparatus in the labaratory of the scrotum, whereby their young friends might be accommodated with an olfactory talent, to enable them to ferret out the lurking place of their better half.*

Impregnation is however most probably carried on by absorption. The vagina has an admirable disposition to facilitate and promote this

* Speculat. on Impregnation.

this absorption. The vires of gonorrhœa, is absorbed by the canal of the uterus. Shall there be an established communication for disease and its remedies, between the vagina, and the general circulating system? And shall not a mild fluid, yet possessed of activity equal to that of any poison, and created for the highest and best purposes, be permitted to traverse the same channels? Sterility, as independent of disqualification in the male, may almost always be traced to an incapacity of absorption in the genital system of the female, or a depravation of the general system. Hence, the naturally delicate, and habitually luxurious, are incomparably less prone to conception than the more robust, and less artificial; and hence, a woman before puberty is incapable of impregnation, and after the cessation of the catamenia, is in the same situation. To the unfortunate creatures, whose lives are inordinately dissipated and immoral, and who cannot escape general debility, and more particularly, topical relaxation, and, if we may use the phrase, sensual imbecility, sterility almost always happens. But, when they renounce their debilitating practices, before their constitutions are irrecoverably destroyed

stroyed, they often regain the tone of health and become capable of being impregnated.*

There is a class of philosophers, it is very certain, who attend so exclusively to facts, and deal so much in experiment, that they seem to have given up reason altogether. They will believe nothing, but what is proved by the evidence of sense. For instance, having established the egg system in one family, they would extend it to all others. The doctrine of *omnia ex ovo*, they would apply to the various parts, as well as to the whole system of the universe. As animals engender animals, so have stones been said to engender stones; mountains to engender mountains; airs to engender airs; oceans to engender oceans; planets to engender planets; suns to engender suns; and all through the medium of eggs. And hence the reason why the satellites of Jupiter were not discovered before the year 1610; nor those of Saturn before the year 1655; because, it was at those precise epochas the eggs were incubated, in which those satellites were enveloped. And hence, Herschel's discoveries may be nothing more than the discoveries of new births: the eggs of the stars he has added to

* Speculat. on Impregnation.

to the astreal list, might have been laid in the days of Copernicus, although it required the number of years which has passed between Copernicus and Herschel, to give them to us hatched and free of incumbrance.

The polypi, and several species of worms, as we have frequently observed, are capable of forming anew those parts, of which they have been deprived by design or accident. Their simplicity of construction; their gelatinous consistency; their uniformity of organization; these, indeed, altogether considered, might have afforded a specious foundation for a theory of animal re-productions. But, the observations of Trembley, of Geneva, who first enlightened mankind as to the phænomena of the polypus, shew how carefully even the best established general laws are to be admitted. This animal entirely oversets every hypothesis of generation. It exhibits fecundity without coition; multiplication without eggs; and animals, who grow from dissections, from slips, and from cuttings. At the same time, it is equally clear in point of fact, that most animals are multiplied and perpetuated by copulation; though many, as the greatest number of birds, propagate rather by a

kind

kind of compressure, than a proper copulation.* But, there are instances of more extraordinary propagation. Spallanzani has *artificially* fecundated oviparous animals. He has artificially impregnated viviparous animals, in which fecundation is external. He has even succeeded in viviparous animals, in which fecundation takes place in the body of the female. The experiment was made on the female of the canine species. He injected the semen of a dog, by a syringe, into the matrix. She littered three lively whelps, two male, and one female; resembling, in colour and shape, not the mother only, but the father also from whom the seed had been taken. He had been careful, indeed, to give the syringe the degree of heat, which dogs are found to possess.† In this country of England, I am informed, an experiment similarly conducted was made upon a female of the human species; and that the result was the same, impregnation, and consequent birth.

To a naturalist, as well as to a metaphysician, the living system is a constant miracle. The manner how, and the time when the intelligent principle begins its operations, is not more inexplicable than the manner how, and the time when

* Buffon. † Spallanzani.

when the corporeal faculties begin their evolutions. The question then is, in fact, of very little moment; nor ought we to quarrel with philosophers, who derive us from an egg, from a worm, or from organic molecules, provided their doctrines do not lead to the blind, fortuitous combination of atoms. In the ovarium of the original mother of mankind, we are told, there were eggs, which contained not only all the children she produced, but, all the human race; that, in short, all animals which have existed, or can exist, were created at once, and included in their first mothers.* If this be allowed, it may be demanded, whether all similarly organized bodies were contained in the first semen? Whether the first plant contained all its numerous progeny, and the first of the living race, all its incalculable descendants? An infinite progression like this, makes every individual a source of eternal generation. But, what greater difficulty to the mighty Creator of all, to continue existence by successive formation, than by original succession?

But, are all the races of mankind, for instance, to be fairly deduced from the same parent? Or how are we to suppose such discordant

* Valisnieri.

cordant species to have sprung from the same common mother? If men have been continued in succession from egg to egg, must there not have been in Eve, eggs of different colours, or, at least, of materially different qualities, and discriminating energies? These are points I own myself incapable of ascertaining. At the same time, it is not unnatural to look back with veneration, as well as with restless curiosity, to that source, whence we date our material origin. It is not uninstructive even to cast a retrospective glance upon our seemingly humble and unapt microscopic state; and to contemplate what appears to us as a shapeless embryo, a gelatinous particle without form or texture, with as much wonder and embarrassment as the stupendous fabric, which it afterwards evolves, can possibly extort from us. Different races of quadrupeds, it is said, have been artificially generated, as well as different species of plants, and why not different races of men? Different races of men have been propagated:—observe the gradations of tint and other peculiarities, in the inhabitants of the West India islands; a fact, which instead of militating against the opinion of an original diversity, rather implies such diversity; else in the

mixture there would have been no difference of substance or quality.

St. Augustine, who was more inclined to deal in metaphysical, than in natural researches, gives us a detail of cripples, and what he calls monstrous kinds of men, such as those having but one eye in the forehead; pigmies; sciopodæ; cynocephali, and such like; and then demands, whether it was from Adam, or the sons of Noah, such beings had proceeded?* We have already seen, that each seed and ovum contains the animal and vegetable proper to its species. Now, when two or more of these animal ova are fecundated and come into the the uterus, the sides of the ova, or membranes that contain the fluids in which the little organizations swim, must inevitably come into contact; and if the membranes of each continue in a good state, the fætuses will be free in their several apartments, and grow separately in due proportion; but, if the parts of the membranes which are close together, by being thin and weak, or by any irregular resistance or friction, come to be dissolved or broken, then the fluids of both unite, and the two little organizations, having no longer a partition between them, come

* De Civit. Dei.

come together, adhere, and entwine into each other, their parts easily coalescing; and from the natural disposition of each, to grow and increase, their accretion goes on; there is a mutual insinuation of vessels where the parts are compressed, and a mutual confused circulation carried on, till at length the whole becomes irregular and monstrous. We have many facts to corroborate this opinion, and to shew, that the fibres of animals and vegetables have a wonderful capacity of extending and insinuating themselves into one another; and of continuing a circulation reciprocally, and the blood vessels of being elongated where the restoration of a part requires it. Else, how should tumours of a monstrous size be produced on the surface of animal bodies? How should the lungs adhere to the *pleura* so intimately as to become one entire united mass, as incapable of being separated as any part of a muscle? How should the buds of trees, implanted into others by grafting or inoculation, so insinuate their fibres into those of the stock in which they grow, as to become one continued piece of wood with them? How are the *sutures* of the scull, and those of the *epiphyses* of the bones, totally obliterated in an advanced

age, but by the insinuation and reciprocal combination of the fibres of each other? And, in a word, how are many recent wounds so soon agglutinated, if there be not a speedy insinuation of vessels, and a circulation soon carried on? *

If the fætus, indeed, be compressed and confined, injury, in every possible way, may result to its formation. This we observe in vegetables. A carrot, parsnip, radish, and such like, which naturally grow straight and well formed, may be distorted and altered at pleasure, as they grow, by compression: for, as the nutritious juices are equally distributed, and attracted in the same quantity into the plant, for the use of the whole, if a compression be made on any part, those juices which are hindered to flow into such compressed parts, will be determined elsewhere, and make gibbosities and deformities in other parts of the organization where the resistance is less, and the whole will become changed from its natural form. Thus, gourds, as they grow, in applying pressure by ligatures, or otherwise, may be brought to various shapes; and apples, pears, &c. placed in cylindrical phials whilst they are small, will by

* Parsons.

by the lateral pressure lose their roundish form, and acquire that of a cylinder. And thus nuts, apples, &c. may be conjoined and become double while young and minute, and not because there was any supposed superfluity of matter to form them by any subordinate help; and thus a nut, apple, &c. among a bunch of sound ones, may, by the compression of its organization be vitiated and ill-formed, but, not because there wanted a sufficiency of this supposed matter. In this manner, it may be supposed, most animal and vegetable monstrosities happen.* The existence of *corporeal attractions* is consequently indisputable. They are the assimilations and adhesions of constituent particles from nutrition; and their conversion into certain states of the blood and body peculiar to each individual, is as undoubted, as the growth and expansion of the material consistency. In instances which are daily before our eyes, do not the fat and corpulent attract and retain from their food, abundance of oily particles? Do not the thin or slender attract less oil, but more earth and gluten? Do not the pale attract serous particles of blood? The florid, what composes red particles? The sallow coloured, a considerable portion of coagulable lymph?

* Parsons.

And do not these corporeal attractions give the different appearances among human beings, in the articles of size and complexion? Even many of the diseases incident to humanity, as well as the propensities stamped upon the embryo, *ab origine*, are, perhaps, attributable to these corporeal attractions. A gross habit of body, produces indolence; a slender habit, activity and alertness; a pallid habit, debility and slowness; a florid habit, warmth of constitution, and quickness of temper. And do not most of the differences of mental sufferance in one and the same disease among different valetudinarians, arise also from this variety of corporeal attractions, acting upon intellectual sensation? *

Every deviation from that original form and structure, which gives the distinguishing character to the productions of nature, may not improperly be called monstrous. According to this acceptation of the term, the variety of monsters will be found infinite. There is not a species of animal, nay, there is not a single part of an animal body, which is not subject to extraordinary formation.† But then, what are

* Rowley. † John Hunter.

are we to say of the sexual distinctions in the proles, and of those combinations and deviations which so frequently occur in the animal kingdom. Avicenna* sums up a great many causes for masculinity, and femineity, as his translator expresses it. For the former, on the production of males, the heat and abundance of the *sperma virile*; its being promoted from the right testicle; because, it is of a thicker consistence, more hot, and drawn from the right rein, *è reno dextro*; which is, says he, both warmer and higher than the other, as being nearer the liver; its falling into the right side in the coitus, &c. And, on the other hand, for the latter, that the females are engendered by causes contrary to these. And all these opinions he gathered from Hippocrates, Galen, and Rhasus. His own, however, seems a modification. If the semen runs, says he, from the right side of the man to the same of the woman, it produces a male; and from their left sides a female; and if from the man's left side to the right of the woman, the production will be a masculine woman; but, if from his right to her left side, it will be a feminine man.

* De Causis Masculinitatis.

You

You will smile at these generative explications. But recollect, that it is a forbidden land which these philosophers would conjecturally explore. They incautiously, indeed, have given way to the suggestions of imagination, more than to the analogies of reason, and have adopted ideas both unsubstantial and groundless; but, it is at the same time to be remembered, that during the pursuit, they have, by some accurate and ingenious discoveries and observations, added greatly to the stock of useful knowledge, and rendered the path more easy to their successors. How sincerely we always wish such men to be right! There can be none whose opinions a man is more inclined to think well of, than those who are ingeniously in the wrong, who have the art to add grace to error, and who can dignify mistake. In animals, however, just born, or very young, there are no peculiarities of shape to distinguish one sex from the other, exclusive of what relates to the organs of generation. As they approach to maturity, the male loses the resemblance he had of the female, and assumes discriminating secondary properties. Not, indeed, universally, for in fishes there is no great difference, nor in many insects, nor in dogs, &c. It is evidently, however, the male which recedes from the female

female in these respects. Every female, being at the age of maturity, more like the young of the same species, than the male is observed to be; and if the male be deprived of his testes when young, he retains more of the original youthful form, and is therefore more similar to the female.*

Some of the Greek and Arabian physicians imagined a great analogy between the male and female genitals as to their structure, and strenuously asserted, that these differ in nothing but their situation; they compared the cervix and vagina uteri to the penis, and the fundus to the scrotum, these only being inverted, or rather, not protruded; and that which hinders their protrusion in women, said they, is the want of heat and sufficient force of nature.† The consequence of this was, in course, in their opinion, frequent changes of sex. Several of the Jewish rabbins, also, and most of the Hebrews, were of opinion, that Adam was first made an *androgynus*, on the fore part a male, and behind a female; and that these were afterwards separated, and the female part called Eve. This was their manner of explaining those passages of the Old Testament, "Male and female created he

* John Hunter. † Ægineta.

he them;" and again, "Thou hast formed me behind and before." Others, indeed, believed they were both *hermaphrodites*.*

But, all these changes of sex have been most commonly said to have been made from women to men, and not from men to women. In serious truth, however, there is often a change of the secondary properties of one sex into those of another; the female, in such respects, now and then assuming the peculiarities of the male. This is often remarked in the common pheasant. When wild, and even sometimes when tame, the hen is often observed with the feathers of the cock; it does not breed, and the spurs do not grow. This, perhaps, may proceed from age, or from other constitutional circumstances. But, this not only obtains in birds, but probably to a certain degree in every class of animals. We find something similar taking place even in the human species; for that increase of hair observable on the faces of many women in advanced life, is an approach towards the beard, which is one of the most distinguishing secondary properties of man. Thus the female, at a period of life when the powers of propagation cease, loses many of her pecu-

* Parsons.

peculiar properties, and may be said, except from mere structure of parts, to be of no sex; and even recedes from the original character of the animal, approaching in appearance towards the male, or, perhaps more properly, towards the hermaphrodite.*

Hermaphrodites may be divided into two kinds, the natural and the unnatural. The first belongs to the inferior and more simple genera of animals, of which there are a much greater number than of the more perfect: but, as animals become more complicated, have more parts, and each part is more confined to its particular use, a separation of the two necessary powers for generation has also taken place. The unnatural hermaphrodite, I believe, now and then occurs in every tribe of animals, having distinct sexes; and is to be met with in all its gradations, from the distinct sex, to the complete union of the male and female organ, but, is more common in some than in others. In the human species, for instance, more rarely than in any other, for Hunter says, he never has seen the phænomenon. He says the same of dogs and cats; but in the horse, ass, sheep, and black cattle, he declares it to be very frequent.

The

* John Hunter.

The hermaphrodites seen by him, always appeared externally, and at first view, to be females. It is a fact known, that when a cow brings forth two calves, and one of them is a bull calf, and the other to appearance a cow, that the cow calf is unfit for propagation, but, the bull calf becomes a proper bull. This cow calf is in this country called a *free martin*. It is a real hermaphrodite, never breeds, or shews the least inclination for the bull, nor is ever taken the least notice of by the bull. It is very susceptible of growing fat; and the flesh, like that of the ox or spayed heifer, is in common, much finer in the fibre, than either the bull or cow, and is supposed to exceed that of the ox and heifer in delicacy of flavour.*

Among the ancients, these prodigies, or monsters, as they were denominated, in nature, were at various periods, most inhumanly dealt with. In the Hebrew law, there is often harsh coercive mention made of hermaphrodites, although they were not very solicitous about the causes of their confused natures. The word *androgynus* was familiar among the Israelites, signifying, one having the parts of generation of both sexes. Androgyni, in their natures, they

* John Hunter.

they esteemed partly as men, partly as women; partly as both man and woman; and partly as neither man nor woman, but as they appear in their proper persons. And hence they held an hermaphrodite to be among the infamous, to whom the gates of dignity ought not to open.* The Romans, soon after the foundation of their city, made laws against androgyni remarkably severe; for whenever a child was reputed one of these, his sentence was to be shut up in a chest alive, and thrown into the sea.† Other nations have likewise been ferociously rigorous in this respect. Even in modern days, and even in England, we have not been free from similar prejudiced care, in providing laws against the unfortunate. A great lawyer, however, has put a saving clause in their favour, for he says, every heir is either male or female, or an hermaphrodite, that is, both male and female: and an hermaphrodite, which is also called an androgynus, shall be heir either as male or female, according to that kind of sex which most prevails, and accordingly ought to be baptized.‡

* Casper Bauhinus. † Eutropius.

‡ Coke.

We

We are told there was a nation of androgyne in Africa, beyond the Nasamones; that every one of them bore the characteristics of the male and female sex, one of their breasts being that of a man, and the other that of a woman.* And this answers the derivation of the word Ερμαφροδιτος, coumpounded of Ερμης, Mercury, and Αφροδιτη, Venus. But, this very fertile climate of wonders, it is not to be believed, ever produced a race of such animals, *sui generis*. If we credit some writers, indeed, it has given birth to one race of human beings with tails; and to another, without the most universal of all faculties, the faculty of speech. But, the days of superstition and ignorance are now so rapidly passing away, that unhappy creatures, distorted only in some particular parts, are neither to be treated as infamous nor vile; nor are we to consider them other than as accidental deviations from the primary organization of nature. Neither are we, in unphilosophic barbarity, any longer to make severe laws against them, supposing them to be capable of exercising the functions of either sex, with regard to generation; and restraining them under rigorous penalties to adhere to that sex

* Pliny.

sex only which they should deliberately fix upon as the most eligible.

In nature, there is supposed a general prototype of every species, upon which each individual is modelled, but, which seems in its actual production to be depraved or improved by circumstances. To obtain good grain, beautiful flowers, &c. the seeds must be changed, and never sown in the same soil that produced them. In the same manner, by mixing races, or by crossing the breed of different climates, beauty of form, and every other useful quality, are brought to perfection, and *vice versa*. The evils which result from alliances of the same blood have been so glaring, that even among the most unpolished nations, a brother has rarely been permitted to marry his sister. But, which parent is it which affects most powerfully the progeny's external form? From numerous experiments and observations, says Buffon, I am convinced, that not only in horses, but in man, and every other animal, the male has more influence on the external form of the young than the female; and that in every species, the male is the principal type of the race. The female, indeed, has an influence upon the character, but she never improves it. The

male alone enjoys the faculty of supporting the purity of the race, and of rendering it more perfect.*

I am aware, that according to the minutest microscopical enquiry, the *ovulum*, containing the rudiments of the future animal, remains in the female ovarium, inert, and without any perceptible action whatever of heart or arteries, until it be impregnated by the male. It is then, the pulsation, or *punctum saliens*, becomes evident. But, as I cannot but suppose that the mother has had an equal share with the father, in the formation of the infant, so I see no reason, notwithstanding Buffon's want of gallantry, why the female should be considered as inferior to the male. In looking about us, I am mistaken, if we shall not find as many children like their mothers, as like their fathers. But, whether this be the case or not, how are we to account for a child's being neither like his father nor mother, but, being remarkably like his grandfather or his grandmother? This is a fact that frequently occurs, and is a difficulty, which would puzzle even Buffon himself.

* Buffon.

More-

Moreover, there are national, as well as family features. Some climates, are certainly more favourable to the perfection of mankind than others; though by migration, they are not so much degraded as other animals. While men continue in the same climate, and even in the same district, an uniform peculiarity of feature and figure prevails among them. But, when they migrate, or when they are corrupted by the migrations of others, this national distinction is in some respects impaired. The Jew is nearly the same in all climates, for he does not intermarry. An Englishman, a Frenchman, a Dutchman, a Spaniard, an Italian, and a German, may, even without any peculiarity of dress, be almost always distinguished. In another sense, likewise, it is to be considered, whether, in some circumstances, the mother is not even more intimately connected with the form of her infant, than the father. What is the probable account given by naturalists, of the marks of children in the womb from the imagination of the mother? How do they explain the plastic power in the fætus, being within the plastic power of the mother, and being acted upon by the same spirit of nature? And what do they say to the strong and impulsive

imagination of the mother, by a concurring action in the same plastic spirit in the fætus, affecting the tender and increasing parts of the fætus, and, like an impulsive signature, leaving the impression behind?

All this I know has been lightly treated by learned and ingenious men. It has been said, that children are never intrinsically marked by the imagination of their mothers. They may be injured by an unnatural compression, while in the embryo or fætus state. The connection between the mother and the child being so intimate, that even any violent agitation of spirits, any mental inquietude, any apprehension, any horror, may be readily supposed to have necessarily some considerable effect upon that, which at the moment, makes an essential part of herself. But, to believe that a woman brought into the world, a child with its limbs all broken in precisely the same places, in which she had seen a criminal's broken in suffering the extremities of torture, and to attribute this to imagination, is rather, say they, being credulous overmuch. I do not know what to say to this. We hear constantly of marks originating in fright, and others, even in certain dispositions of appetite

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to eat this, or that sort of food: and yet, it is true, we never, or very rarely, I will acknowledge, hear of a woman frightened by an animal, being delivered of a child with any of the external properties of that animal; or longing, as it is called, for a fruit, being delivered of a child with branches, leaves, blossoms, or fruit, sprouting from its trunk or limbs. The subject is, however, inexplicable. While the fætus is forming in the mysterious womb of nature, it is impossible for us to learn, what impressive energy the mind of the parent may have upon the body of the expanding offspring. During the first nine months of its existence, it is confined in a dark prison, debarred from light and air. It is not until an *habeas corpus* sets it at liberty, that we are permitted to judge of its consistency, and its positive or adventitious qualities. Yet imagination, or a revulsion of spirit, causing compression, does certainly occasion extraordinary alterations in the animal figure; and therefore it is not altogether philosophical, to laugh at the universally received ideas upon the subject; for though they cannot be satisfactorily demonstrated, yet they cannot be altogether refuted.

I have said above, that Buffon is of opinion, the male gives the resemblance to the offspring, even to the offspring of mules. This is remarkable, that from a jack-ass and a mare, the offspring is like the ass; and from a horse and ass, the offspring is like the horse. This, however, I believe, does not rigidly hold good in the mixtures of the different races of the human species. The traits of the female, I must repeat it, are as frequently distinguishable as those of the male. But, be this as it may, the growth of the human body is exceedingly curious. In the womb, the fætus progressively increases in size, more and more in equal times, till it escapes its confinement. The child, on the contrary, is continually less and less rapid in its growth, till the age of puberty, to which it makes a sudden bound, and soon acquires its full stature. At the end of the first month it is an inch long; and at the end of the ninth, it is eighteen inches. But, in the next twelve months, it only acquires six or seven; the next, four or five; the next, three or four; and afterwards, till puberty, not above one and a half, or two inches a year. Thus the fætus grows more in the last month, than the child does in the year.* In nine months, from

* Buffon.

from being smaller than a pin's head, it gains the surprizing bulk of eighteen inches in height, and of proportionate general expansion.

We have still, however, one very material point relative to animal existence to learn; and that is, whether mules be barren or fruitful. Because mules produced by the mixture of the horse with the she ass, or the jack-ass with the mare, are sterile, we conclude that mules of every kind must be deprived of the power of transmission. But, may not this opinion, says Buffon, be false? We have no proper information concerning the *jumar*, an animal said to be produced by the cow and jack-ass, or by the mare and bull; whether the zebra can produce with the horse or ass, &c. Our ignorance of these facts is almost invincible. The ancients, indeed, tell us, the mule produces at the age of seven years; and that it likewise produces with the mare. "*Mulus septennis implere potest, & jam cum equa conjunctus hinnum procreavit.*" * Upon this question, says the French naturalist, we may consider it, I think, as an established fact, that the he mule can generate, and the she mule produce. Like

* Aristotle.

other animals, they have a seminal liquor, and all the organs necessary to generation. But, mongrel animals are always less fertile, and more tardy, than those of a pure species.

LETTER LXII.

IN the preceding letter, I found it necessary to clear the way, by perhaps too many circumstantial details, and by too regular a narration of particulars, which, however, lay the foundation of principles, and suggest matter for discoveries and observations. Truth propagates truth. Nor is there any danger, I must hope, in pursuing nature to her last ramifications. A scrupulous enumeration on interesting subjects, may be of utility. The dignity of the whole, cannot be injured by attention to the parts. It is said to us, indeed, though figuratively, I know, in Scripture, " *that which thou sowest is not quickened except it die.*" * And what is singular, certain appearances in the progress and succession of organic bodies, may serve to shew that the idea is neither preposterous nor chimerical. Putrefaction is evidently the great process appointed by the Creator, for the resolution of ani-

* St. Paul.

animal and vegetable substances into the elements from which they were first formed. By this, every thing is reduced to one common lot. This resolution of bodies is no less wonderful than their formation. Every seed produces its own plant; every animal, one of its own species: they live, they are nourished, and each retains its individual nature. They decay, they die, return to their elementary state, and are again employed as the constituent parts of other vegetables, and other animals. Such is the amazing circle of life and death.

An increase of life, results from death. The extinction of animality is so far from being injurious, that it is both advantageous and necessary. And thus in the wonderful œconomy of nature, the living substance suffers no diminution from individual dissolution. Its very destruction serves to re-produce it. The flame of life, after it is extinguished in one class of animals, immediately re-kindles in another, and burns with fresh lustre and undiminished strength. Whatever has birth, must have death. The density of the bones increases; the interstices are filled and obstructed; the circulation of the fluids ceases; the membranes are changed into car-

cartilages, and the cartilages into bones; the fibres of the muscles grow rigid; the skin is deprived of its moisture, and wrinkles are gradually formd in it; the hair turns hoary; the teeth fall out; the visage assumes a haggard appearance; the body bends forward; and death ensues. Among the numerous individuals of the human species, these inevitable concomitants of existence, are various in their periods, as in their appearances. In women, particularly, the bones, muscles, and cartilages being softer and less solid than those of men, and consequently requiring more time to harden, they live longer generally than men.*

Were it not for this extinction of life, the earth would be inadequate to the support of its own animation. When we reflect on the amazing fecundity of each species, the rapid and prodigious multiplication of particular animals, which come forth in myriads to scatter destruction around them, we are astonished they do not oppress nature by their numbers, and after desolating her productions, fall victims to the universal waste they have created. Thick clouds of winged armies of famished insects, in an instant annihilate the labours and the hopes of

* Buffon.

of nations. Animated deluges of vermin ravage every thing, and infect the air with the putrid emanations of their dead carcases. Myriads of ants produce indescribable devastation. Greeks, Romans, Normans, Huns, Goths, Tartars, and others, rush from their savage homes, and fell their bleeding species with the murderous sword of war. The same restrictions seem laid upon man, that are imposed upon other animals. We cherish or multiply, neglect or destroy, our fellow-creatures, according to the advantages or inconveniencies which result from them.*

Putrefaction has been denominated the master key of the existences of nature. It is ever in action, visibly, or invisibly. It is incessantly decomposing the various bodies of organization. It causes decay in the vegetable kingdom; it rots the creatures who possess animal life. The plant, however, it makes spring from the putrescent earth of the animal; and the animal from the fermented juices of the plant. The peasant, who covers his little field with manure, does not know what this process is, which occasions its fertility. Are we much wiser, in regard to animal fertility? We know, indeed, that

* Buffon.

that we are engendered, and that, too, amongst fermenting and elaborated fluids. We know that we derive our growth from such juices. And we know, that we at last, like every thing in nature, fall into decay and dissolution. Putrescent organized bodies form the vegetable earth, enrich the soil, and force out the corn and fruits. The whole seems a system of putrefaction and re-generation. Each moment teems with rottenness and with life: the surface of the earth is simply a mass of corruption.

Nature, however, is wisely and uniformly employed, in so changing this product of putrefaction, as to render it generally either innocent or useful. Were not this the case, the quantity accumulated would be soon so great, as to destroy the whole race of mankind. It is not easy to trace her steps. Dispersion and vegetation may be supposed to have considerable efficacy. Dispersion, by ventilation and by winds, which changes the atmosphere; vegetation, for air, which has been rendered unwholesome by respiration or putrefaction, is meliorated, and again made fit for the support of animal life, by the growth of vegetables. In no circumstances are vegetables seen so vigorous,

gorous, as in an air freshly and strongly tainted with putrefaction, and which is immediately fatal to animal life. Plants, therefore, as we have often observed, reverse the effects of breathing, and tend to keep the atmosphere sweet and wholesome; plants, I mean under the influence of light, which is a phlogistic process acting upon the resinous parts of plants only, and is the grand pabulum of vegetables, the completion of the putrefactive process, and the consequent return of the putrefying subject to its elementary state. Fire and smoke have likewise been found powerful correctors of putrid effluvium. By the digestive process the aliment is so changed, as to become a part of the animal which it nourishes; and by the putrefactive process, this animal passes into a state of dissolution, loses its texture and organization, and rises into the air in the form of vapour. Part of this vapour is absorbed by growing vegetables; nourishes them, and becomes a part of their substance; and thus the air is so far freed from the noxious impregnation. What remains, is still further dispersed; and passing by the wise provision of nature, through various changes and combinations, returns to the state

state of elements; and these elements become parts of other vegetables and other animals.*

It has been said, minerals have their configuration and increase in the body of the earth simply; vegetables, their roots in the earth, but the faculty of raising themselves, in water and in air; and animals their birth in earth, water, and in air: air being thus to all, the grand principle of existence; earth and water, parts of their consistency; and fire, or heat, the prime agent. For, do not all terrestrial matters, say they, resolve themselves into those elements of which they originally were formed? The elements have derived their existence from water and spirit, and to water and spirit they return. Do not all vegetables burst into being, and owe their organic expansion to air, to water, and to fire? And are not animals formed, preserved, destroyed, and re-generated by the same elements? The author of a singular work,† says, "All things have been in a chaotic fluid; all things are to return to a chaotic fluid. The world itself was a chaotic fluid, crystalline, clear, transparent, without odour or taste. All the elements were harmoniously and chymically blended. But, suddenly an invisible spirit

* Dobson. † Nature Devoilè.

spirit arose, insinuated itself, and set it in motion. It then fermented, became troubled, threw out of itself an earth, putrified, and became offensive. The parts then separated. The more subtile formed the æther; the next the air; the next the water; and the last the earth. These parts, however, do not differ: they are all of the same chaotic fluid, but varied by subtility and fixity. Even the fluids that descend in rain and dew, in hail and snow, are nothing but the re-generated chaos. Examine what they contain: collect a small quantity; put it in a liquid state in a vessel; close the vessel hermetically: you then have it crystalline, clear, transparent, as the water of the fountain. In a month, (and it has imbibed no adventitious impurity) you will find a considerable alteration. It begins to be actuated by the spirit with which it is invisibly charged. It gets warm; becomes progressively heated; putrifies; becomes offensive and nebulous. The spirit, or motion, effects a separation. The subtile parts would fly off in vapour. An earth increases in the process, which from its weight at length subsides to the bottom. This is glutinous, viscous, oleagenous. May it not, therefore, be the universal *gubr?* All animals derive their existence from a watery or slimy substance

stance, nourished by other aqueous and succulent substances in the womb, which by the natural alchymy, is changed into flesh, blood, skin, bones, &c. Do not they return to what they sprung from, a slimy, glutinous liquid?" *

In a close inspection of the beings of this globe, a very striking affinity is undoubtedly to be traced. Let us assemble, for a moment, all the quadrupeds into one group, and let the intervals, or ranks, represent the proximity or distance between each species. The ape makes a near approach to man. The bats are the apes of birds. The porcupines and hedgehogs, by the quills with which they are covered, seem to indicate that feathers are not confined to birds. The armadillos, by their scaly shells, approach the turtle and the crustaceous animals. The beavers, by the scales on their tails, resemble fishes. The ant-eaters, by their beak or trunk, without teeth, and the length of the tongue, claim affinity to aquatic tribes. In fine, the seal, the walrus, and the manati, are a separate corps, and make a great projection with a view to arrive at the cetaceous classes, though they are more nearly allied to quadru-

* Nature Devoilè.

peds.* But, in the inscrutable chain of animal affinities, what ultimate link connects the macrocosm with the microcosm? Or how, in the wildness of system, can the creation of a world, be compared with the propagation of an animal?

Nothing can be deprived of its substance or materiality; for, as in generation, nothing of matter is produced that did not before exist, so in corruption, nothing more is lost than that particular modification, which was its form, and constituted it of a particular species. The principle of corruption is perhaps the same which, in a state of circulation, is one of the principles of life; namely, the air, which is found mixed in considerable quantities with all sorts of fluids, as necessary to vegetable as to animal life. Spinoza, indeed, maintains, that there is but one substance in nature, whereof all created things are so many different modifications; and thus he makes the soul of the same substance with the body; and the globe of the same substance with the grasshopper. The whole universe, according to him, is but one substance; which he holds to be endowed with an infinity of attributes, in the num-

* Buffon.

number of which are thinking and extension. All bodies are modifications of this substance, considered as extended; and all spirits, modifications of the same substance, considered as thinking. Body, which in philosophy is a solid, extended, palpable substance, of itself merely passive, and indifferent either to motion or rest, but capable of any sort of motion, and of all figures and forms, is composed, according to the Peripatetics, of matter, form, and privation; according to the Epicureans and Corpuscularians, of an assemblage of hooked, heavy atoms; according to the Cartesians, of a certain quantity of extension; according to the Newtonians, of a system or association of solid, massy, hard, impenetrable, immoveable particles, ranged or disposed in this or that manner; whence result bodies of this or that form, distinguished by this or that name.

That all bodies agree in one common matter, the schoolmen themselves allow, making what they call the *materia prima*, to be the basis of them all, and their specific differences to spring from their particular forms: and since the true notion of body consists, either alone in extension, or in extension and impenetrability together, it will follow, that the differences,

which make the varieties of visible bodies, do not proceed from the nature of mere matter, of which we have but one uniform conception, but, from certain attributes, such as motion, size, position, &c. which we call mechanical affections. We are as far from an idea of the substance of body, in having the complex idea of extended, figured, coloured, and all other sensible qualities, which is all we know of it, as if we knew nothing at all; nor after all the acquaintance and familiarity which we imagine we have with matter, and the many qualities men assure themselves they perceive and know in bodies; will it, perhaps, on examination, be found, that they have any more, or clearer primary ideas belonging to body, than they have belonging to immaterial spirit. The primary ideas we have peculiar to body, as contradistinguished from spirit, are the cohesion of solid, and consequently separable parts; and a power of communicating motion by impulse. These are the original ideas, proper and peculiar to body; for figure is but the consequence of finite extension. Thus the idea of the substance of spirit, is equally clear and well known to us, as the idea of the substance of body.*

Fire,

‡ Locke.

Fire, according to Zeno the Stoic, is diffused through all the parts of the world, and they are severally and conjointly sustained by it. That it is in the earth, appears by seeds and roots, which spring up and grow by the temperament of the heat; for whatever is nourished and grows, comprises within itself the principle of heat. That it is in water, is evident, because water is susceptible of greater cold, as by freezing. And that it is in air, is equally demonstrable, for air is a vapour extracted from water, and supplied by the motion of the heat, which is in the water. But, primarily, and originally, it is in the element of fire, which disperses salutary, vital warmth to all things.* Newton proposes the question, whether æther may not be the cause of gravity, of the different attractions, and of every motion, both animal and vegetable? In her annual progress, the earth experiences, from the different aspects of the sun, the regulated variations which we call seasons. As a necessary consequence, most of her productions experience the like vicissitudes. In winter, certain animals, and certain plants, are in a kind of lethargy; in spring, they seem re-animated, and roused out of a long torpor; in summer, they are in the height

* Stobæus.

of vigour. Again, it is asked, whether it be not those inflammable and spiritous substances which men imbibe, which accelerate the organic functions, and rapidly increase the general circulation?

Every motion, it has been conceived, causes heat, whether perceptible or not. In most terrene animals, this heat is sensible. But, aquatic beings, though almost incessantly in motion, have no heat whatever. They are in the very opposite extreme, they are cold. Nevertheless, life seems to be necessarily caused by heat or motion, for coldness and immobility extinguish the vital spark. There is, indeed, a sensible and an insensible igneous principle; and of this latter, fishes abundantly partake. From observations and experiments, it appears to be a law of nature in animal bodies, that the degree of external heat should bear a proportion to the quantity of life: as it is weakened, this proportion requires great accuracy; while greater powers of life allow it greater latitude. It is upon these principles, that cold air is found of so much benefit to people who are reduced by disease, as fevers, &c. by diminishing heat, in proportion to the diminution of life; or lessening the necessity of the body's producing its

own

own cold. Thus, in persons *frost-bitten*, the effect of cold is that of lessening the living principle. The powers of action remain as perfect as ever, only weakened, and heat is the only thing wanting to put these powers into action. Yet, heat must at first be gradually applied, and proportioned to the quantity of the living principle; but, as that increases, you may increase the degree of heat. If this method be not observed, and too great a degree of heat be first applied, the person, or part, loses entirely the living principle, and mortification ensues. This process invariably takes place with regard to man. The same, probably, happens to other animals. The degree of heat must not be increased too suddenly for the proportion of life remaining in the animal.*

But why, as I asked in a former letter, does cold accelerate the growth of fur? To this it is not easy to reply. Extreme cold, indeed, we know, in some respects, produces similar effects to those of violent heat. The Samoiedes, the Laplanders, and the natives of Greenland, are tawny; the latter, even black as the Africans. May not this be occasioned by the dryness of the air, which, perhaps, is equally

* John Hunter.

great in extreme cold, as in extreme heat? Both cold and heat dry the skin, and give it a tawny hue. Cold contracts all the productions of nature; and hence the reason, why man, though the only animal on whom nature has bestowed the power of multiplying in every climate of the earth, is comparatively diminished in frozen regions. The Laplanders are the smallest of the human species. And hence, says Buffon, in support of his vitreous hypothesis, the reason why many classes of beings have disappeared; for instance, the mammouth, whose enormous bones were at least six times larger than those of the largest elephant.

The close harmony between the life and organization of bodies, has induced some philosophers to imagine, that life is no other than a certain combination of organs, which are kept in a perpetual motion, by mutually acting upon each other.* But, this sentiment seems to confound life with motion; two things which are very distinct in the ideas of every man, as indeed they are in themselves. The motion of a body, of whatever kind it be, will have no effect upon the nature and properties of that body; it merely changes its position relative to ano-

* Le Clerc.

another body; and there is an immense difference between this idea, and that of sensibility, which constitutes one of the most essential qualities of animal life. Were conjecture capable of satisfying us, the germ of life might indeed be considered as a substance, bearing a strong resemblance to fire. Should any one ask, in what this resemblance consists, it might be answered, that as fire is kindled by fire, thus does life generate life: that, weak and wavering in its rise, active and impetuous in the midst of its career, languid and exhausted at the close, the progress of a *living*, is exactly similar to that of an *inflamed* substance. This, at first, is but a spark, a glimmering light, scarcely able to support itself; by spreading, it changes into an impetuous flame, and, after having surprised us with its lustre, it is spent, and extinguishes of itself. We might add, that as inflammable substances require a perpetual supply of nutritive air, so the living substance cannot subsist without constant supplies of the same nutritive aliment; that as fire seizes and consumes whatever is its proper aliment, so does organized life fix upon, and devour, whatever affords it sustenance; that as fire may be extinguished by too large a quantity of combustible materials, as well as by the want of them, so

may

may a superfluous quantity, as well as a deficiency of food, prove equally prejudicial to life; that those materials, which produce the most violent effects upon living bodies, (as certain spirits, for example) have precisely the same influence upou inflamed ones; that each requires air, for its support: in a word, it might be remarked, that it is only by the kindly influence of heat, that a living body experiences the first expansion of its germ; it is this which rears it to its summit of perfection; and after having introduced animated bodies into being, it acts the part of a nurse, and of a guardian, in preserving the requisite flexibility of their fibres, and the motion of their fluids.

But, conjecture will not satisfy us on this very intricate subject; nor are we to call life altogether an element, and to compare it with fire. The soul seems to have no decided power, I will allow, until the atmospheric air has rushed into the lungs; for without this, the infant perishes soon after delivery. The air seems to contain the *pabulum vitæ*. During the time the fætus continues in the uterus, there is no reason to suppose it enjoys any of those active qualities of the soul, which display themselves afterwards: it possesses, perhaps, a *stimulum insitum*,

or

or an internal irritability, for the performance of the peculiar circulation of the blood, and some secretions and excretions; but, in itself knows nothing of the one or the other; in short, it has no thinking qualities, no ideas of sense or reflection: the brain is almost fluid, and similar to serum. When excluded from the uterus, some operations of the soul appear immediately after the first respiration; for the child cries, and soon shews a desire for food, and will elect sweet instead of bitter. The circulation of the blood is changed, and performed in a different manner; for instead of passing through the *ductus arteriosus*, *venosus*, and *foramen ovale*, the auricles and venticles receive the blood; the pulmonary arteries and veins acquire their power of circulating the blood through the lungs; and this is a mode that continues through life.* The positive faculties of the soul thus unfold themselves with respiration, and with the cessation of respiration, would seem to be lost: the principle of life, would seem as fugitive as the element of air.

But in fact, though air be only conjecturally supposed the pabulum of life, it yet is more than supposition, that it is the pabulum of fire; if

* Rowley.

if not fire itself, in its purest state, agreeably to the present generally received chymistry. That which has been the doctrine, therefore, relative to the origin of animal heat, is reducible to the fundamental question, concerning the change of vital air into aerial acid, and of this into corrupted air: an opinion, which every day receives confirmation.* Of the composition of an animal, we have already spoken at large. Its material part, animal earth, as it is called, is obtained indiscriminately from every class of beings. It is obtained either from the shells of fishes; or from those of eggs; or from pearls; or from the bones, horns, claws of land animals; or from the skins of insects. That obtained from the shells of fish, and from those of eggs, is purely calcareous; only oyster-shells discover some feeble vestiges of salenite. That obtained from bones, horns, claws, teeth, &c. is also a calcareous earth, united to a phosphoric acid.†

This, indeed, is the earthy residium of the animal substance. But, what are we to conceive concerning the immediate connection of the mind with the body? How do they reciprocally

* Bergman. † Kirwan.

cally act on one another? How are the sensations distinctly conveyed? Or, what are the means, by which they are communicated through the nerves to the brain? This invisible agency must ever remain beyond ocular demonstration, or the utmost limits of the most comprehensive human intellect. It is only clear, that the something, which is sufficiently powerful to act on human matter during life, has its principal residence in the brain and nerves, which latter pervade every part of the body. Not that the nervous influence is clearly known, excepting in its effects. The discovery of a nervous fluid, is far from having received the sanction of the learned. All we know is, that an increased or decreased energy, in the nervous system, causes an increased or decreased arterial action, nervous influence, or the *vires insitæ* of the muscles. What miserable objects have men of the best understandings presented, when these have been united with too great nervous sensibility! But, however this be brought about, it is not rational to suppose, that any liquid, such as a nervous fluid, can pass and repass with such rapidity as thought itself, either through tubes, supposing they were existing, or by transudation. Yet, destroy the nerve going to any part, and the power of motion and sense in the

part

part wholly ceases, or is but very imperfectly performed. Persons of strong health never experience the extreme of nervous sensibility, even though the mind be violently affected: it happens only to the delicate in mind, and feeble in body. What changes in the disposition of the most placid, tranquil minds, during the continuance of an enervating disease! The best tempers become captious. The soul perceives every thing through a cloud, and no balmy rays of comfort ever find admission. The state of the blood, therefore, the form of the body, and their action on the nervous system, together with the action of this nervous system on the immaterial part called mind, cause most of the diversity of character which we find among human beings, and has an unequivocal influence on the moral conduct of human life.*

Self love feels more for its passions, than for its opinions; and thus the immaterialist will not admit of what is most evident, the influence of body upon mind, as his antagonist will not admit the influence of mind upon body. This subject has already occupied much of our attention, and therefore any thing further concerning it would

* Rowley.

would be superfluous. Locke says, the ideas as well as the children of our youth die before us; and our minds represent to us those tombs to which we are approaching; where, though the brass and marble remain, yet the inscriptions are effaced by time, and the imagery moulders away. In some, says he, the mind retains the characters drawn on it, like marble; in others, like free-stone; and in others, little better than sand. Disease sometimes strips the memory of all ideas; the flames of a fever, in a few days will calcine all past images to dust and confusion. In fact, if we except the number of years which are peculiar to old age, as well as the external marks of decrepitude and decay, can we find any two things so strikingly alike, as the infant and the octogenary? Both of them have white hairs, and they are without teeth. Both of them find the wholesomest nourishment in milk, and the most simple diet. Both are forgetful, indiscreet, and what is stiled childish. The more a man advances in years, the more this affinity is apparent. The commencement and the end of animal existence, as described by the poets, touch, or nearly run into each other. The extinction of the vital spark at length approaches. Hoary, venerable age then drops into the grave, as little terrified, and with

as little perception of death, as infancy drops into the world, unconscious of its existence.

It was held by some wise men of antiquity, and has been acquiesced in by moderns, as an eternal verity, that there never was, nor could be in nature, any such thing as annihilation. Others, indeed, made the world eternal, and void of all corruption: for not being able to comprehend whether the egg or the bird were first generated, since no bird could be without an egg, nor any egg without a bird, they therefore conceived the world, and the beginning of every begotten thing, together with the end of all, to be, by perpetual revolution, sempiternal. Even the Stoics, who believed a final conflagration, did not admit of annihilation; but, that there would be a new heaven and a new earth; or rather, that the Almighty Wisdom would produce some new fabric inconceivable by us, who are, in truth, unable to conceive any thing, of which we have not positive experience. Something, say they, cannot be created out of nothing; neither can annihilation turn something into nothing. Hence it follows, that as there is no access, so there can be no diminution, in the universe. Look at a burying place. Dig into a cemetery of the dead. In

every

every shovel full that is thrown up, you will find the fragment of a bone or skull intermixed with a kind of fresh mouldering earth, which some time or other had a place in the composition of the human body. What innumerable multitudes of people lie confused together! How men, women and children, priests and soldiers, politicians and peasants, opulent and poor, tyrants and slaves, are crumbled and blended indiscriminately in one common mass! How beauty, strength, and youth, with old age, weakness, and deformity, lie undistinguished in the same promiscuous heap of now unconscious matter!

Man, as every thing else on this globe, may be looked upon as in a state of constant vicissitude. The final term of his existence is as unknown to him, as was that of his first conformation. *Destructio unius, generatio alterius.* But, are we thence to conclude, that there is nothing which is either born or dies in nature? It has long, indeed, been said, there is neither birth nor death, as they are relative to mortals, but, simply a combination, and a separation of that which was so combined. And are not they weak, we are asked, in understanding, or men of confined ideas, who imagine that any thing

is born that did not exist before? Or, that any thing can die, and perish eternally? *

The extent to which this sort of reasoning was carried by the schools, we have already had occasion to examine and discuss. Out of it, however, grew the wretched system of Atheism, and its concomitant fortuitous combination of atoms, as relative to animal existence. Man, says the inconsistent denier of an ever acting Providence, is the production of nature, formed without design by the different combinations of matter and motion. The earth thus, though devoid of sentiment and intelligence, is absurdly held to have produced this marvellous being. The millions of parts which form the human frame, were heretofore scattered through the globe; by accident they came together, how or when no one can tell; they at length arranged themselves into body; and, what is most astonishing of all, produced life, sentiment, and the faculty of reasoning. To save the pain of forming each individual, the beings thus first organized were formed male and female, so that for the future, the species should be kept up by generation. And last of all, to complete the work, the force of gravity, and the

* Empedocles.

the reciprocity of this material impulsion, furnished the forefathers of the human race with arts and sciences, and with all the sublime exertion of the immaterial intellect. But, if at any period nature, of her own accord, could have produced such organized beings, such animals, such minerals, as we now see, whence comes it, that since that wonderful moment, she never should have produced any others? Has she changed, or has she become barren? Why do not the same fortuitous arrangements of atoms take place now as heretofore? Surely the earth is not altered, otherwise the descendants of the first created man could not have been nourished and preserved.*—Can you conceive any thing more tremendously philosophical than this infinite series of children, without any originally created parents?

The little we know of this world, and of ourselves, should at least impress us with humility. No wise man can venture peremptorily to define the different states in which we primarily were, absolutely are, or ultimately may be. But, we have now finished our subject. The systems we have adverted to of the moderns, we have clearly traced to the ancients, who,

* Holland.

most probably, were themselves but borrowers. Neither is Buffon, nor any of his contemporaries, to run away even with the revival of such ideas. Puerari, in his Dissertations, published at Geneva in 1662, gives the greatest part of the molecule system of organization. Sir Kenelm Digby, in his treatise, *De Naturâ Corporum*, still seems to have beeen more explicit.* With respect to the egg hypothesis, we have had the strongest proofs of its antiquity. The same we have had of the sexual distinction of plants. Even with respect to one of the greatest supposed modern discoveries, Hippocrates, it is evident, was acquainted with the circulation of the blood. *Communicant autem omnes venæ, & confluent inter se mutuo.* I acknowledge, says he, I do not know where the tide commences, nor where it ends: for in a circle, one can neither find beginning nor ending. The heart and the veins, however, are always in motion. He compares the streams which return to their source by variegated canals, to the blood in circulation. Plato and Aristotle, after Hippocrates, have many passages to the like effect. Apulèius, treating of this sentiment of Plato, mentions it with as much precision as Harvey himself could have done. He does not, it is true,

* Senebier.

true, say, that the blood parts from the heart by the arteries, but he makes it in going from the heart, take the route of the lungs, and thence spread itself through all the parts of the body. *Sic exponit sententiam Platonis: sed regione venarum meatus oriuntur, per pulmonis spiracula vivacitatem transferentes, quam de corde susceperunt, & rursus ex illo loco divisæ per membra, in totum hominem juvant spiritum.** In being thus particular, I do not mean to detract from well-earned reputation. An ample dividend of praise always remains to authors of candour and veracity, though not original; for to them must be assigned the plan of their composition, the distribution of its parts, the choice of their proofs, the train of their arguments, and what is yet more, the general predominance of their discrimination and judgment. My object is widely different. As we proceed, it will be further developed.

Plato, however, (and it is with extravagancy I am now contending) endeavoured to prove that the world is endowed with wisdom, because, "a world is greater than any of its parts; therefore it is endowed with wisdom; for otherwise a man, who is endowed with wisdom,

* Duten.

dom, would be greater than the world."* Zeno endeavoured to prove the world to have the use of reason by an argument of the same kind. Pope Gregory, writing in favour of the four councils, Nice, Constantinople, Ephesus, and Calcedon, reasons thus: "That as there are four evangelists, there ought also to be four councils." Josephus, in his answer to Appian, on the subject of the Temple of Jerusalem, says; "As there is but one God, and one world, it holds in analogy, there should be but one temple." At that rate, also, there should be but one worshipper. For why should that one temple be at Jerusalem, rather than at Rome or Pekin? Many reasonings thus have passed current in the world as good coin, which really, both in premises and conclusions, have been absurd. Marriage, within the fourth degree of consanguinity, as well as of affinity, is prohibited by the Lateran Council: and why? Because, the body being made up of the four elements, has four different humours in it. "Quaternarius enim numerus bene congruit prohibitioni conjugii corporalis; de quo dicit apostolus, quod vir non habet potestatem sui corporis, sed mulier; neque mulier habet potestatem sui corporis, sed vir; quia quatuor sunt

* Cicero.

sunt humores in corpore, quod constat ex quatuor elementis." Thus, the wisest among the wise, and in all ages, have frequently been betrayed into weakness of reasoning. Yet we laugh at the poor Indian, who supports the earth from falling by an elephant, and the elephant by a tortoise. Is his figure less solid in its foundation, than the celebrated Buffon's hypothesis, of a splinter from the sun? We are by the apostle, to pray always; from which Jerom, one of the fathers, argues thus, "Conjugal enjoyment is inconsistent with praying; ergo, conjugal enjoyment is a sin." Eating and drinking, by the same argument, are sins; and sleep must be a deadly one, for it is a complete interruption to praying.

In a word, we should always be upon our guard against creatures and systems of human imagination, and should learn to respect nothing as conducive to philosophy, but facts sufficiently vouched, or conclusions drawn from them by a fair and chaste interpretation of nature. At the same time, it is equally incumbent on a liberal and an enlightened mind, not to think an investigation trifling, because the truth is not, to his apprehension, immediately evident: for amid the collision of ideas in the human understanding,

ing, and the latent, and infinitely varied relations of natural objects, it must ever be hazardous to pronounce any fact so barren, as not to be capable, either in the affirmation or the negation, of suggesting ingenious speculation, or of conducting to important discovery.

MVSEVM
BRITAN
NICVM

END OF THE THIRD VOLUME.